

JAWAPAN

MATEMATIK TAMBAHAN

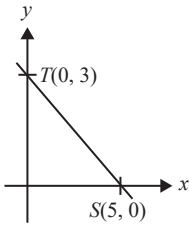
Dwibahasa

KERTAS 1

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
1	$\log_a x^2 y = \log_a x^2 + \log_a y$ $= 2 \log_a x + \log_a y$ $\log_a \frac{y^2}{x^2} = \log_a y^2 - \log_a x^2$ $= 2 \log_a y - 2 \log_a x$ $2 \log_a x + \log_a y = 6 \dots\dots\dots \textcircled{1}$ $2 \log_a y - 2 \log_a x = 5 \dots\dots\dots \textcircled{2}$ $\textcircled{1} + \textcircled{2} : 3 \log_a y = 11$ $\log_a y = \frac{11}{3}$ $\textcircled{1} : 2 \log_a x + \frac{11}{3} = 6$ $2 \log_a x = \frac{7}{3}$ $\log_a x = \frac{7}{6}$ $(a) \log_a y^2 x = \log_a y^2 + \log_a x$ $= 2 \log_a y + \log_a x$ $= 2 \left(\frac{11}{3} \right) + \frac{7}{6}$ $= \frac{17}{2}$ $(b) \log_a \frac{x}{y} = \log_a x - \log_a y$ $= \frac{7}{6} - \frac{11}{3}$ $= -\frac{5}{2}$	6	6

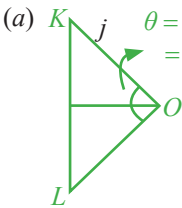
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
2	$(a) \quad 5^{3x+1}(5^{2x}) = 1$ $5^{3x+1+2x} = 5^0$ $3x+1+2x = 0$ $5x = -1$ $x = -\frac{1}{5}$ $(b) \quad \left(\frac{15p^4q^2}{5pq^7}\right)^3 = \left(\frac{3p^3}{q^5}\right)^3$ $= (3p^3q^{-5})^3$ $= 27p^9q^{-15}$	4	4
3	$(a) \quad \tan(30^\circ + x) = \frac{\tan 30^\circ + \tan x}{1 - \tan 30^\circ \tan x}$ $= \frac{\frac{\sqrt{3}}{3} + m}{1 - \frac{\sqrt{3}}{3}m}$ $= \frac{\sqrt{3} + 3m}{3 - \sqrt{3}m}$ $(b) \quad \cos(45^\circ - x) = \cos 45^\circ \cos x + \sin 45^\circ \sin x$ $\cos(45^\circ - x) = \cos 45^\circ \cos x + \sin 45^\circ \sin x$ $= \frac{\sqrt{2}}{2} \left(\frac{1}{\sqrt{m^2+1}} \right) + \frac{\sqrt{2}}{2} \left(\frac{m}{\sqrt{m^2+1}} \right)$ $= \frac{\sqrt{2}}{2} \left(\frac{1+m}{\sqrt{m^2+1}} \right)$ $= \frac{\sqrt{2}}{\sqrt{2}\sqrt{2}} \left(\frac{1+m}{\sqrt{m^2+1}} \right)$ $= \frac{1}{\sqrt{2}} \left(\frac{1+m}{\sqrt{m^2+1}} \right)$ $= \frac{1+m}{\sqrt{2(m^2+1)}} // \frac{m+1}{2} \sqrt{\frac{2}{m^2+1}}$	6	6
4	$(a) \quad \int_2^6 f(x) dx = \int_4^6 f(x) dx + \int_2^4 f(x) dx$ $= 40 + 28$ $= 68$ $(b) \quad \int_4^6 [3f(x) + k] dx = \int_2^4 f(x) dx$ $3 \int_4^6 f(x) dx + \int_4^6 k dx = \int_2^4 f(x) dx$ $3(40) + k[x]_4^6 = 28$ $120 + k(6-4) = 28$ $120 + 2k = 28$ $2k = -92$ $k = -46$	5	5

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
5	(a) $d = 9 - 5$ $= 4$ (b) $a = 5, d = 4$ $T_n = a + (n - 1)d$ $T_{20} = 5 + 19(4)$ $= 81$ (c) $S_{12} - S_4 = \frac{12}{2} [2(5) + 11(4)] - \frac{4}{2} [2(5) + 3(4)]$ $= 324 - 44$ $= 280$	6	6
6	(a) $p = 0.6, q = 0.4$ $P(x \geq 7) = P(x = 7) + P(x = 8) + P(x = 9) + P(x = 10)$ $= {}^{10}C_7(0.6)^7(0.4)^3 + {}^{10}C_8(0.6)^8(0.4)^2 + {}^{10}C_9(0.6)^9(0.4)^1 + {}^{10}C_{10}(0.6)^{10}(0.4)^0$ $= 0.2150 + 0.1209 + 0.0403 + 0.0060$ $= 0.3822$ (b) $P(X \leq 8) = 1 - P(X > 8)$ $= 1 - P(X = 9) - P(X = 10)$ $= 1 - {}^{10}C_9(0.6)^9(0.4)^1 - {}^{10}C_{10}(0.6)^{10}(0.4)^0$ $= 1 - 0.0403 - 0.0060$ $= 0.9537$	6	6
7	(a) ${}^4P_1 \times {}^8P_5 = 4 \times 6\,720$ $= 26\,880$ (b) ${}^7C_1 + {}^7C_2 + {}^7C_3 + {}^7C_4 + {}^7C_5$ $= 7 + 21 + 35 + 35 + 21$ $= 119$	4	4
8	(a) $\underline{p} + \underline{q} = \binom{2}{6} + \binom{3}{k}$ $= \binom{2+3}{6+k}$ $= \binom{5}{6+k}$ (b) $\underline{p} + \underline{q} = 5$ $\sqrt{5^2 + (6+k)^2} = 5$ $25 + 36 + 12k + k^2 = 5^2$ $k^2 + 12k + 36 = 0$ $(k + 6)(k + 6) = 0$ $k = -6$	5	5

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
9	(a) $f^{-1}(x) = \frac{x-1}{x}$ Katakan $y = \frac{x-1}{x}$ Let $yx = x - 1$ $1 = x - yx$ $1 = x(1 - y)$ $x = \frac{1}{1 - y}$ $f(x) = \frac{1}{1 - x}; x \neq 1$ (b) $g(x) = 3x - 2$ Katakan $y = 3x - 2$ Let $x = \frac{y + 2}{3}$ $g^{-1}(x) = \frac{x + 2}{3}$ $g^{-1}f(x) = g^{-1}\left(\frac{1}{1 - x}\right)$ $= \frac{\left(\frac{1}{1 - x}\right) + 2}{3}$ $= \frac{\frac{1 + 2 - 2x}{1 - x}}{3}$ $= \frac{\frac{3 - 2x}{1 - x}}{3}$ $= \frac{3 - 2x}{3(1 - x)}; x \neq 1$	6	6
10	(a) Koordinat $S(5, 0)$ dan $T(0, 3)$ Coordinates $S(5, 0)$ and $T(0, 3)$ $m_{st} = \frac{0 - 3}{5 - 0}$ $= -\frac{3}{5}$		

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	(b) Titik tengah garis lurus, M <i>The midpoint of the straight line, M</i> $= \left(\frac{5}{2}, \frac{3}{2} \right)$ $\therefore y = \frac{5}{3}x + c$ $\frac{3}{2} = \frac{5}{3} \left(\frac{5}{2} \right) + c$ $c = \frac{3}{2} - \frac{25}{6}$ $= -\frac{8}{3}$ $\therefore y = \frac{5}{3}x - \frac{8}{3}$	5	5
11	(a) $s = \int v \, dt$ $= \int (15 + 2t - t^2) \, dt$ $= 15t + t^2 - \frac{t^3}{3} + c$ Pada $c = 0$, $s = 15t + t^2 - \frac{t^3}{3}$ At $c = 0$, $s = 15t + t^2 - \frac{t^3}{3}$ Apabila $t = 5$, When $t = 5$, $s = 15(5) + 5^2 - \frac{5^3}{3}$ $= 58\frac{1}{3} \text{ m}$ (b) Apabila zarah bergerak ke arah kanan, $v > 0$. <i>When the particle moves to the right, $v > 0$.</i> $15 + 2t - t^2 > 0$ $(t - 5)(t + 3) > 0$ $t < -3$ atau / or $t > 5$ Oleh sebab $t \geq 0$, zarah bergerak ke kanan apabila $t > 5$. <i>Since $t \geq 0$, the particle moves to the right when $t > 5$.</i>	6	6
12	(a) $m = \frac{26 - 1}{6 - 1}$ $= \frac{25}{5}$ $= 5$ $\therefore \frac{y}{x} = 5 \left(\frac{1}{x^2} \right) + c$ Pada $(1, 1)$, At $(1, 1)$, $1 = 5(1) + c$ $c = -4$ $\therefore \frac{y}{x} = 5 \left(\frac{1}{x^2} \right) - 4$		

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	Apabila $\frac{y}{x} = 4$, When $\frac{y}{x} = 4$, $4 = 5\left(\frac{1}{x^2}\right) - 4$ $8 = 5\left(\frac{1}{x^2}\right)$ $8x^2 = 5$ $x^2 = \frac{5}{8}$ $x = \sqrt{\frac{5}{8}}$ (b) $y = \frac{a}{x} + bx$ $\frac{y}{x} = \frac{a}{x^2} + b$ $\frac{y}{x} = \frac{5}{x^2} - 4$ $\therefore a = 5, b = -4$	5	5
13	(a) $h = 2.5r$; $V = \pi r^2 h$ $= \pi r^2 (2.5r)$ $= 2.5 \pi r^3$ $\frac{dV}{dr} = 7.5 \pi r^2$ $= 456.3\pi$ $\frac{dV}{dt} = \frac{dV}{dr} \times \frac{dr}{dt}$ $2.3 = 456.3\pi \times \frac{dr}{dt}$ $\frac{dr}{dt} = 1.604 \times 10^{-3} \text{ cm s}^{-1}$ (b) $y = kx^3 + 6x^2 + 7x$ $\frac{dy}{dx} = 3kx^2 + 12x + 7$ $x = 3$, $\frac{dy}{dx} = 3k(3)^2 + 12(3) + 7$ $= 27k + 43$ $x = 5$, $\frac{dy}{dx} = 3k(5)^2 + 12(5) + 7$ $= 75k + 67$ $27k + 43 = 75k + 67$ $48k = -24$ $k = -\frac{1}{2}$	4	8

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
14	(a)  $\sin \theta = \frac{j}{\left(\frac{KL}{2}\right)}$ $KL = \frac{2j}{\sin \theta}$ Perimeter tembereng KL/Perimeter of segment $KL = 41.3$ $S_{KL} + KL = 41.3$ $j(0.67\pi) + \frac{2j}{\sin 120.6^\circ} = 41.3$ $4.428j = 41.3$ $j = 9.326 \text{ cm}$ Perimeter kawasan berlorek/Perimeter of the shaded region $= KL + S_{\text{major } KL}$ $= \frac{2(9.326)}{\sin 120.6^\circ} + 9.326(2\pi - 0.67\pi)$ $= 60.637 \text{ cm}$ (b) $\angle XOY = 3.142 - 0.531 - \left(53 \times \frac{3.142}{180}\right)$ $= 1.686 \text{ rad}$ Luas segmen/Area of the segment $= \frac{1}{2} r^2 (\theta - \sin \theta)$ $= \frac{1}{2} (15.7)^2 (1.686 - \sin 1.686)$ $= 85.36 \text{ cm}^2$	4	8
15	(a) $x = y + 5$ ① $y^2 = 7x^2 - 9$ ② Gantikan ① ke dalam ② Substitute ① into ② $y^2 = 7(y + 5)^2 - 9$ $y^2 = 7(y^2 + 10y + 25) - 9$ $y^2 = 7y^2 + 70y + 175 - 9$ $0 = 6y^2 + 70y + 166$ $y = \frac{-70 \pm \sqrt{70^2 - 4(6)(166)}}{2(6)}$ $= -3.311 \text{ atau / or } -8.355$ Gantikan $y = -3.311$ ke dalam ① Substitute $y = -3.311$ into ① $x = -3.311 + 5$ $= 1.689$ Gantikan $y = -8.355$ ke dalam ① Substitute $y = -8.355$ into ① $x = -8.355 + 5$ $= -3.355$	4	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(b) $2p + q - 3r = 7$ ① $p - 5q - 2r = 9$ ② $3p - 4q + 6r = 12$ ③ $② \times 2 : 2p - 10q - 4r = 18$ ④ $① - ④ : 11q + r = -11$ $r = -11 - 11q$ ⑤ $① \times 3 : 6p + 3q - 9r = 21$ ⑥ $③ \times 2 : 6p - 8q + 12r = 24$ ⑦ $⑥ - ⑦ : 11q - 21r = -3$ ⑧ Gantikan ⑤ ke dalam ⑧ Substitute ⑤ into ⑧ $11q - 21(-11 - 11q) = -3$ $11q + 231 + 231q = -3$ $242q = -234$ $q = -0.9669 // -\frac{117}{121}$ Gantikan $q = -0.9669 // -\frac{117}{121}$ ke dalam ⑤ Substitute $q = -0.9669 // -\frac{117}{121}$ into ⑤ $r = -11 - 11(-0.9669)$ $= -0.3641 // -\frac{4}{11}$ Gantikan $q = -0.9669 // -\frac{117}{121}$ dan $r = -0.3641 // -\frac{4}{11}$ ke dalam ② Substitute $q = -0.9669 // -\frac{117}{121}$ and $r = -0.3641 // -\frac{4}{11}$ into ② $p - 5(-0.9669) - 2(-0.3641) = 9$ $p + 5.5627 = 9$ $p = 3.4373 // \frac{416}{121}$	4	8

KERTAS 2

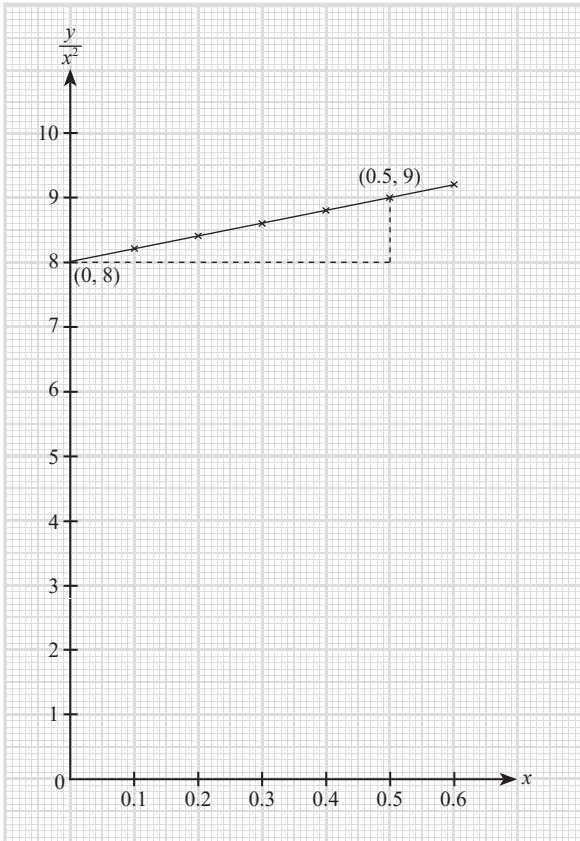
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
1	$6^{x+y} = 36$ $6^{x+y} = 6^2$ $x + y = 2$ (a) $36^{\frac{x}{2}} \cdot 6^y = 12x^2 + 12xy$ $6^x \cdot 6^y = 12x^2 + 12xy$ $6^{x+y} = 12x(x + y)$ $36 = 12x(2)$ $x = \frac{3}{2}$ $\frac{3}{2} + y = 2$ $y = \frac{1}{2}$	3	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
3	(a) $y = 3x^2(x + 3)$ $= 3x^3 + 9x^2$ $\frac{dy}{dx} = 9x^2 + 18x$	2	7
	(b) $9x^2 + 18x = 0$ $9x(x + 2) = 0$ $x = 0 ; x = -2$ $y = 0 ; y = 3(-2)^2(-2 + 3)$ $y = 12$ $\therefore (0, 0) \text{ dan/and } (-2, 12)$	2	
	(c) $\frac{d^2y}{dx^2} = 18x + 18$ $x = 0, \frac{d^2y}{dx^2} = 18 > 0$ (Minimum/Maximum) $x = -2, \frac{d^2y}{dx^2} = 18(-2) + 18 = -18 < 0$ (Maksimum/Maximum) $\therefore (0, 0)$ ialah titik minimum dan $(-2, 12)$ ialah titik maksimum. <i>(0, 0) is a minimum point and (-2, 12) is a maximum point.</i>	3	
4	(a) (i) $\log_a \frac{a^2x}{y^2} = \log_a a^2x - \log_a y^2$ $= \log_a a^2 + \log_a x - \log_a y^2$ $= 2 \log_a a + \log_a x - 2 \log_a y$ $= 2 + 3 - 2(4)$ $= -3$ (ii) $\log_a \frac{\sqrt{y}x}{a} = \log_a \sqrt{y} + \log_a x - \log_a a$ $= \frac{1}{2} \log_a y + \log_a x - \log_a a$ $= \frac{1}{2} (4) + 3 - 1$ $= 4$	4	7
	(b) $\log_a 4 = 2$ $\log_a x = 3$ $\log_a y = 4$ $4 = a^2$ $\log_2 x = 3$ $\log_2 y = 4$ $a^2 = 2^2$ $x = 2^3$ $y = 2^4$ $a = 2$ $x = 8$ $y = 16$	3	
5	(a) $5x + 3y = 4$ ① $2y + 4z = 5$ ② $\textcircled{1} \times 2 : 10x + 6y = 8$ ③ $\textcircled{3} + \textcircled{2} : 10x + 8y + 4z = 13$ Tertunjuk. <i>It is shown.</i>	2	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(b) $5x + 3y = 4$ ① $2y + 4z = 5$ ② Daripada ① From ① $5x + 3y = 4$ $y = \frac{4 - 5x}{3}$ Gantikan $y = \frac{4 - 5x}{3}$ dan $z = 2x - 1$ ke dalam ② Substitute $y = \frac{4 - 5x}{3}$ and $z = 2x - 1$ into ② $2\left(\frac{4 - 5x}{3}\right) + 4(2x - 1) = 5$ $\frac{8 - 10x}{3} + 8x - 4 = 5$ $8 - 10x + 24x - 12 = 15$ $14x = 19$ $x = \frac{19}{14}$ Gantikan $x = \frac{19}{14}$ ke dalam $z = 2x - 1$ Substitute $x = \frac{19}{14}$ into $z = 2x - 1$ $z = 2\left(\frac{19}{14}\right) - 1$ $= \frac{12}{7}$ Gantikan $z = \frac{12}{7}$ ke dalam ② Substitute $z = \frac{12}{7}$ into ② $2y + 4\left(\frac{12}{7}\right) = 5$ $y = -\frac{13}{14}$	5	7
6	(a) Bilangan cara untuk menyusun Adam dan Halim duduk bersebelahan Number of ways to arrange Adam and Halim sit side by side $= (7 - 1)! \times 2$ $= 6! \times 2$ $= 1\,440$ (b) Bilangan cara untuk menyusun 8 orang duduk di sebuah meja bulat The number of ways to arrange 8 people sits at a round table $= (8 - 1)!$ $= 7!$ $= 5\,040$	3	

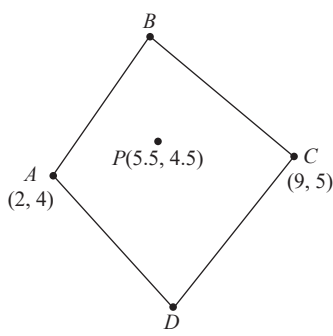
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	Bilangan cara untuk menyusun Durga dan Benny duduk bersebelahan <i>The number of ways to arrange Durga and Benny sit side by side</i> $= (7 - 1)! \times 2$ $= 6! \times 2$ $= 1\,440$ Oleh itu, bilangan cara Durga dan Benny tidak duduk bersebelahan ialah <i>Therefore, the number of ways Durga and Benny do not sit side by side is</i> $= 5\,040 - 1\,440$ $= 3\,600$	4	7
7	(a) Luas sektor $= \frac{1}{2} r^2 \theta$ <i>Area of sector</i> $= \frac{1}{2} r^2 \theta$ $\frac{207\pi}{4} = \frac{1}{2} (9)^2 \theta$ $\theta = 4.0143 \text{ rad}$ (b) Panjang lengkok $AB = r\theta$ <i>Length of arc AB</i> $= r\theta$ $= 9(4.0143)$ $= 36.1287 \text{ cm}$ Perimeter sektor yang berlorek <i>Perimeter of the shaded region</i> $= 36.1287 \text{ cm} + 9 \text{ cm} + 9 \text{ cm}$ $= 54.1287 \text{ cm}$ (c) $\theta = 2\pi - 4.0143$ $= 2.2689 \text{ rad}$ $= \frac{2.2689 \text{ rad}}{2\pi} \times 360^\circ$ $= 130^\circ$ Panjang perentas AB <i>Length of chord AB</i> $= \sqrt{9^2 + 9^2 - 2(9)(9) \cos / \cos 130}$ $= 16.314 \text{ cm}$ Panjang lengkok $AB = r\theta$ <i>Length of arc AB</i> $= r\theta$ $= 9 \left(130^\circ \times \frac{\pi}{180^\circ} \right)$ $= 20.4204 \text{ cm}$ Perimeter tembereng AB <i>Perimeter of segment AB</i> $= 16.314 \text{ cm} + 20.4204 \text{ cm}$ $= 36.7344 \text{ cm}$	2 3 3	8

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
8	(a) $y + x^2 = 16$ Pada/At $x = 0, y + 0 = 16$ $y = 16$ $\therefore D(0, 16)$ $y + x^2 = 16$ $y = -x^2 + 16$ $\frac{dy}{dx} = -2x$ $= -2(2)$ $= -4$ Persamaan tangen: Equation of tangent: $y - y_1 = \frac{dy}{dx} (x - x_1)$ $y - 12 = -4(x - 2)$ $y = -4x + 8 + 12$ $y = -4x + 20$ Apabila/When $x = 0, y = 20$ Apabila/When $y = 0, 0 = -4x + 20$ $4x = 20$ $x = 5$ $\therefore C(5, 0)$ dan/and $A(0, 20)$ (b) $y + x^2 = 16$ Jika/If $16 - x^2 = 0$ $(4 - x)(4 + x) = 0$ $\therefore x = 4 ; x = -4$ Maka, luas rantau berlorek ialah Hence, the area of shaded region is $= \int_2^5 (20 - 4x)dx - \int_2^4 (16 - x^2)dx$ $= [20x - 2x^2]_2^5 - \left[16x - \frac{x^3}{3}\right]_2^4$ $= [[20(5) - 2(5)^2] - [20(2) - 2(2)^2]] - \left[\left[16(4) - \frac{4^3}{3}\right] - \left[16(2) - \frac{2^3}{3}\right]\right]$ $= [50 - 32] - \left[\frac{128}{3} - \frac{88}{3}\right]$ $= 18 - \frac{40}{3}$ $= \frac{14}{3} \text{ unit}^2/\text{units}^2$	3	
		4	

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10	(a) <table border="1"><tr><td>x</td><td>0.1</td><td>0.2</td><td>0.3</td><td>0.4</td><td>0.5</td><td>0.6</td></tr><tr><td>$\frac{y}{x^2}$</td><td>8.2</td><td>8.4</td><td>8.6</td><td>8.8</td><td>9.0</td><td>9.2</td></tr></table>  (b) $y = px^3 + qx^2$ $\div 2 : \frac{y}{x^2} = px + q$ Pintasan-y/y-intercept = 8 Kecerunan/Gradient, $p = \frac{9 - 8}{0.5 - 0}$ $= \frac{1}{0.5}$ $= 2$ $p = 2, q = 8$ (c) $y = px^3 + qx^2$ $= 2x^3 + 8x^2$ Apabila/When $x = 0.73, y = 2(0.73)^3 + 8(0.73)^2$ $= 5.041$	x	0.1	0.2	0.3	0.4	0.5	0.6	$\frac{y}{x^2}$	8.2	8.4	8.6	8.8	9.0	9.2	3
x	0.1	0.2	0.3	0.4	0.5	0.6										
$\frac{y}{x^2}$	8.2	8.4	8.6	8.8	9.0	9.2										

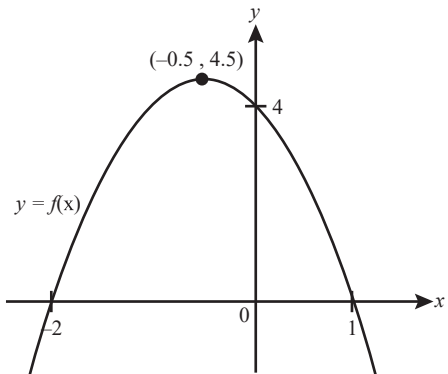
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
11	(a) (i) $\overrightarrow{CF} = \frac{3}{4} \overrightarrow{CB}$ $\overrightarrow{CA} = \overrightarrow{CB} + \overrightarrow{BA}$ $\overrightarrow{CB} = \frac{4}{3} \underline{b}$ $= \frac{4}{3} \underline{b} + (-\underline{a})$ $= \frac{4}{3} \underline{b} - \underline{a}$ (ii) $\overrightarrow{AE} = \frac{2}{7} \overrightarrow{AC}$ $= \frac{2}{7} \left(\underline{a} - \frac{4}{3} \underline{b} \right)$ $= \frac{2}{7} \underline{a} - \frac{8}{21} \underline{b}$ $\overrightarrow{EA} = \frac{8}{21} \underline{b} - \frac{2}{7} \underline{a}$ $\overrightarrow{EB} = \overrightarrow{EA} + \overrightarrow{AB}$ $= \frac{8}{21} \underline{b} - \frac{2}{7} \underline{a} + \underline{a}$ $= \frac{5}{7} \underline{a} + \frac{8}{21} \underline{b}$ (b) $\overrightarrow{DC} = \overrightarrow{DE} + \overrightarrow{EC}$ $h\underline{a} + k\underline{b} = \frac{3}{5}h\underline{a} - \frac{3}{2}k\underline{b} + \frac{5}{7} \left(\underline{a} - \frac{4}{3}\underline{b} \right)$ $h\underline{a} + k\underline{b} = \left(\frac{3}{5}h + \frac{5}{7} \right) \underline{a} + \left(-\frac{3}{2}k - \frac{20}{21} \right) \underline{b}$ $h = \frac{3}{5}h + \frac{5}{7}$ $k = -\frac{3}{2}k - \frac{20}{21}$ $\frac{2}{5}h = \frac{5}{7}$ $\frac{5}{2}k = -\frac{20}{21}$ $h = \frac{25}{14}$ $k = -\frac{8}{21}$ (c) $\overrightarrow{CA} = \frac{4}{3}\underline{b} - \underline{a}$ $\overrightarrow{CA} ^2 = \left[\left(\frac{4}{3} \right) (9) \right]^2 + [(-1)(5)]^2$ $\overrightarrow{CA} = \sqrt{169}$ $= 13 \text{ unit/units}$	4 4 2	10
12	(a) I : $x + y \leq 400$ II : $x \geq 100$ III : $2y \geq x$	3	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks															
	(c) <table border="1"><tr><td>t</td><td>0</td><td>1</td><td>2</td><td>2.5</td><td>3</td><td>4</td><td>5</td></tr><tr><td>v</td><td>6</td><td>2</td><td>0</td><td>-0.25</td><td>0</td><td>2</td><td>6</td></tr></table> (d) $t > 2.5$	t	0	1	2	2.5	3	4	5	v	6	2	0	-0.25	0	2	6	3
t	0	1	2	2.5	3	4	5											
v	6	2	0	-0.25	0	2	6											

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(c)  $PB^2 = PC^2$ $(x - 5.5)^2 + (y - 4.5)^2 = (9 - 5.5)^2 + (5 - 4.5)^2$ $x^2 - 11x + 30.25 + y^2 - 9y + 20.25 = 12.25 + 0.25$ $x^2 + y^2 - 11x - 9y + 38 = 0 \text{ — ①}$ $AB^2 = BC^2$ $(x - 2)^2 + (y - 4)^2 = (9 - x)^2 + (5 - y)^2$ $x^2 - 4x + 4 + y^2 - 8y + 16 = 81 - 18x + x^2 + 25 - 10y + y^2$ $14x + 2y - 86 = 0$ $2y = 86 - 14x$ $y = 43 - 7x \text{ — ②}$ Gantikan ② ke dalam ① Substitute ② into ① $x^2 + (43 - 7x)^2 - 11x - 9(43 - 7x) + 38 = 0$ $x^2 + 1\,849 - 602x + 49x^2 - 11x - 387 + 63x + 38 = 0$ $50x^2 - 550x + 1\,500 = 0$ $50(x^2 - 11x + 30) = 0$ $(x - 6)(x - 5) = 0$ $x = 6 \text{ atau/or } x = 5$ Apabila/When $x = 6$, $y = 43 - 7(6)$ = 1 Apabila/When $x = 5$, $y = 43 - 7(5)$ = 8 $\therefore B(5, 8)$ dan/and $D(6, 1)$	5	10

KERTAS MODEL SIJIL PELAJARAN MALAYSIA 2026 (SET 2)

KERTAS 1

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
1	(a) (i) Selanjar Continuous (ii) Diskret Discrete (iii) Diskret Discrete	3	6
	(b) $P(Z < -m) = \frac{1 - 0.7114}{2} = 0.1443$ $m = 1.061$	3	
2	(a) $(6 - 1)!$ $= 120$ cara/ways (b) $(5 - 1)! \times 2!$ $= 48$ cara/ways	4	4
3	(a) (i) $f(x) = -2x^2 - 2x + 4$ $= -2(x^2 + x - 2)$ $= -2\left[\left(x + \frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2 - 2\right]$ $= -2\left(x + \frac{1}{2}\right)^2 + \frac{9}{2}$ (ii) 	7	7
	(b) (i) Lebar graf berkurang. <i>Width of graph decreases.</i> (ii) Graf dengan bentuk yang sama bergerak secara mengufuk 1 unit ke kanan.//Persamaan paksi simetri adalah $x = \frac{1}{2}$. <i>Graph with the same shape moves 1 unit horizontally to the right.//The equation of the axis of symmetry is $x = \frac{1}{2}$.</i> (iii) Graf bergerak secara menegak 3 unit ke bawah.//Nilai minimum ialah $\frac{3}{2}$. <i>Graph moves vertically 3 units downwards.//The minimum value is $\frac{3}{2}$.</i>		

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks												
4	$y = x^3$ ① $y + \delta y = (x + \delta x)^3$ ② ② – ① : $\delta y = (x + \delta x)^3 - x^3$ $= (x + \delta x)[x^2 + 2x\delta x + (\delta x)^2] - x^3$ $= x^3 + 2x^2\delta x + x(\delta x)^2 + x^2\delta x + 2x(\delta x)^2 + (\delta x)^3 - x^3$ $= 3x^2\delta x + 3x(\delta x)^2 + (\delta x)^3$ $\frac{\delta y}{\delta x} = 3x^2 + 3x(\delta x) + (\delta x)^2$ $\frac{dy}{dx} = \lim_{\delta x \rightarrow 0} [3x^2 + 3x(\delta x) + (\delta x)^2]$ $= 3x^2$ $\delta y = 3(3)^2 \times (-0.02)$ $= -0.54$	5	5												
5	<table><tr><th>Rajah Diagram</th><th>Fungsi Songsang Inverse Function</th><th>Sebab Reason</th></tr><tr><td>5(a)</td><td>Ada Yes</td><td>Garis mengufuk memotong satu titik sahaja pada graf. <i>Horizontal line cuts the graph at only one point.</i></td></tr><tr><td>5(b)</td><td>Ada Yes</td><td>Garis mengufuk memotong satu titik sahaja pada graf. <i>Horizontal line cuts the graph at only one point.</i></td></tr><tr><td>5(c)</td><td>Tiada No</td><td>Garis mengufuk memotong lebih daripada satu titik pada graf. <i>Horizontal line cuts the graph at more than one point.</i></td></tr></table>	Rajah Diagram	Fungsi Songsang Inverse Function	Sebab Reason	5(a)	Ada Yes	Garis mengufuk memotong satu titik sahaja pada graf. <i>Horizontal line cuts the graph at only one point.</i>	5(b)	Ada Yes	Garis mengufuk memotong satu titik sahaja pada graf. <i>Horizontal line cuts the graph at only one point.</i>	5(c)	Tiada No	Garis mengufuk memotong lebih daripada satu titik pada graf. <i>Horizontal line cuts the graph at more than one point.</i>	3	3
Rajah Diagram	Fungsi Songsang Inverse Function	Sebab Reason													
5(a)	Ada Yes	Garis mengufuk memotong satu titik sahaja pada graf. <i>Horizontal line cuts the graph at only one point.</i>													
5(b)	Ada Yes	Garis mengufuk memotong satu titik sahaja pada graf. <i>Horizontal line cuts the graph at only one point.</i>													
5(c)	Tiada No	Garis mengufuk memotong lebih daripada satu titik pada graf. <i>Horizontal line cuts the graph at more than one point.</i>													
6	$\text{sek/sec } A(\tan A + \cot A)$ $= \frac{1}{\cos A} \left(\frac{\sin A}{\cos A} + \frac{\cos A}{\sin A} \right)$ $= \frac{1}{\cos A} \left(\frac{\sin^2 A + \cos^2 A}{\sin A \cos A} \right)$ $= \frac{1}{\cos A} \left(\frac{1}{\sin A \cos A} \right)$ $= \frac{1}{\sin A (1 - \sin^2 A)}$ $= \frac{1}{\sin A \sin^3 A}$	4	4												
7	(a) $\frac{7\sqrt{5}}{\sqrt{5} - 14} \times \frac{\sqrt{5} + 14}{\sqrt{5} + 14}$ $= \frac{35 + 98\sqrt{5}}{5 - 14^2}$ $= \frac{35 + 98\sqrt{5}}{-191}$	3													

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(b) $9(27^x) = 3^y$ $3^2(3^{3x}) = 3^y$ $3^{2+3x} = 3^y$ $y = 3x + 2$ ① $\log_2 y - \log_2 (x - 1) = 1$ $\log_2 \frac{y}{x - 1} = 1$ $\frac{y}{x - 1} = 2$ $y = 2x - 2$ ② ① - ② : $0 = x + 4$ $0 = x + 4$ $x = -4$ $y = 3(-4) + 2$ $= -10$ $x = -4, y = -10$	4	7
8	(a) $a + 2d = x$ ① $a + 6d = y$ ② ② - ① : $4d = y - x$ $d = \frac{y - x}{4}$ $a = x - 2\left(\frac{y - x}{4}\right)$ $= \frac{3}{2}x - \frac{1}{2}y$ (b) $n = 2029 - 2022 + 1 = 8$ $T_{2030}(T_8) = 10\,000 \times 1.04^{8-1}$ $= \text{RM}13\,159.32$ $n = 2039 - 2029 + 1 = 11$ $T_{2040}(T_{11}) = 13\,159.32 \times 1.05^{11-1}$ $= \text{RM}21\,435.15$	3	7
9	$y = kx^3$ $\log_2 y = 3 \log_2 x + \log_2 k$ $\log_2 k = -1$ $k = \frac{1}{2}$ $\frac{h - (-1)}{2 - 0} = 3$ $h = 5$	4	4
10	(a) (i)		

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	$(ii) \vec{PQ} = \sqrt{4^2 + (-2)^2}$ $= \sqrt{20} // 2\sqrt{5} // 4.47$ $(b) v = \sqrt{6^2 + 12^2}$ $= 6\sqrt{5} \text{ km j}^{-1}/\text{km h}^{-1} // 13.42 \text{ km j}^{-1}/\text{km h}^{-1}$ $\alpha = \tan^{-1}\left(\frac{6}{12}\right) = 26.57^\circ$ $\theta = 270^\circ + 26.57^\circ = 296.57^\circ$	3	
		3	6
11	$(a) 2j + j\theta = 30 \dots\dots\dots ①$ $\frac{1}{2}j^2\theta = 14 \dots\dots\dots ②$ $(b) \theta = \frac{30 - 2j}{j}$ $\frac{1}{2}j^2\left(\frac{30 - 2j}{j}\right) = 14$ $j^2 - 15j + 14 = 0$ $(j - 14)(j - 1) = 0$ $j = 14, 1$ $j = 14, \theta = \frac{30 - 2(14)}{14} = \frac{1}{7} \text{ rad}$ $j = 1, \theta = \frac{30 - 2(1)}{(1)} = 28 \text{ rad}$ $\theta = 0.1429 \text{ rad}$ $(\theta = 28 \text{ rad tidak diterima kerana melebihi } 2\pi)$ $(\theta = 28 \text{ rad is not accepted because more than } 2\pi)$ $j = 14 \text{ cm}$ $(j = 1 \text{ cm tidak diterima kerana } \theta \text{ yang setara adalah } 28 \text{ rad})$ $(j = 1 \text{ cm is not accepted because the equivalent is } 28 \text{ rad})$ $j = 14 \text{ cm}, \theta = 0.1429$	2	
		2	4
12	$(a) \text{ Bukan, kerana } 2x + y = zx \text{ bukan persamaan linear.}$ $\text{No, because } 2x + y = zx \text{ is not a linear equation.}$ $(b) x + y + z = 2 \dots\dots\dots ①$ $y - 3z = 1 \dots\dots\dots ②$ $2x + y + 5z = 0 \dots\dots\dots ③$ $\Rightarrow ②, y = 1 + 3z \dots\dots\dots ④$ $\text{Gantikan/Substitute } ④ \text{ ke dalam/into } ①$ $x + (1 + 3z) + z = 2$ $x + 4z = 1$ $x = 1 - 4z \dots\dots\dots ⑤$ $\text{Gantikan/Substitute } ④ \text{ dan } ⑤ \text{ ke dalam/into } ③$ $2(1 - 4z) + (1 + 3z) + 5z = 0$ $2 - 8z + 3z + 1 + 5z = 0$ $3 = 0$ $\text{Sistem persamaan linear ini tiada penyelesaian kerana } 3 \neq 0.$ $\text{This system of linear equations has no solution because } 3 \neq 0.$	1	
		4	5

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
13	(a) $\frac{x-x_1}{x_2-x_1} = \frac{m}{n}$ $x(m+n) = nx_1 + mx_2$ $x = \frac{nx_1 + mx_2}{m+n}$ $\frac{y-y_1}{y_2-y_1} = \frac{m}{n}$ $y(m+n) = ny_1 + my_2$ $y = \frac{ny_1 + my_2}{m+n}$ $P(x, y) = \left(\frac{nx_1 + mx_2}{m+n}, \frac{ny_1 + my_2}{m+n} \right)$ $\therefore$ Tertunjuk/Shown (b) $RH_1 = \left(\frac{1(6) + 2(-6)}{1+2}, \frac{1(4) + 2(-2)}{1+2} \right)$ $= (-2, 0)$ $RH_2 = \left(\frac{2(6) + 1(-6)}{2+1}, \frac{2(4) + 1(-2)}{2+1} \right)$ $= (2, 2)$	4	8
14	(a) (i) $4x - 4 = 0$ $x = 1$ $(1, -4)$ (ii) $\frac{d^2 y}{dx^2} = 4$ Titik minimum/Minimum point (b) $y = \int (4x - 4) dx$ $= 2x^2 - 4x + c$ $-4 = 2(1)^2 - 4(1) + c$ $c = -2$ $y = 2x^2 - 4x - 2$	5	8
15	(a) (i) $f^2(x) = \frac{\left(\frac{x-1}{x}\right) - 1}{\left(\frac{x-1}{x}\right)}$ $= \frac{1}{1-x}, x \neq 1$ $f^3(x) = x$ (ii) $f^{36}(x) = x$ $f^{36}(2) = 2$	3	1

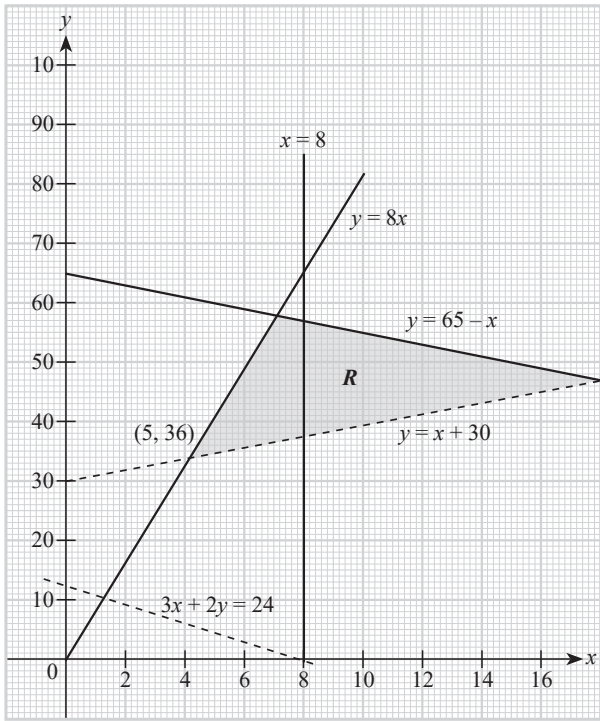
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
2	(a) $a = 0.888\ldots$ ① $10a = 8.888\ldots$ ② $② - ① : 9a = 8$ $a = \frac{8}{9}$ 0.888... ialah nombor nisbah kerana dapat ditulis dalam bentuk nisbah, $\frac{p}{q}$. 0.888... is a rational nombor because can be written in the ratio form, $\frac{p}{q}$. (b) $m\sqrt{20} = m\sqrt{7} + \sqrt{3}$ $m\sqrt{12} - m\sqrt{7} = \sqrt{3}$ $m(\sqrt{12} - \sqrt{7}) = \sqrt{3}$ $m = \frac{\sqrt{3}}{\sqrt{12} - \sqrt{7}}$ $m = \frac{\sqrt{3}}{\sqrt{12} - \sqrt{7}} \times \frac{\sqrt{12} + \sqrt{7}}{\sqrt{12} + \sqrt{7}}$ $m = \frac{6 + \sqrt{21}}{5}$ $\frac{p + \sqrt{q}}{5} = \frac{6 + \sqrt{21}}{5}$ $p = 6, q = 21$	3	6
3	(a) (i) $\frac{10!}{2! \times 2! \times 2!} = 453\ 600$ (ii) $\frac{5! \times 6!}{2! \times 2! \times 2!} = 10\ 800$ (b) (i) ${}^{10}C_5 = 252$ (ii) ${}^6C_2 \times {}^4C_3 = 60$	3	6
4	(a) $1 - \tan x \sin 2x$ $= 1 - \left(\frac{\sin x}{\cos x} \right) (2 \sin x \cos x)$ $= 1 - 2 \sin^2 x$ $= \cos 2x$ (LHS) (b) (i)	2	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(ii) $2 \sin 2x = 1 - \frac{x}{\pi}$ $-\frac{3}{4}(2 \sin 2x) = -\frac{3}{4}\left(1 - \frac{x}{\pi}\right)$ $-\frac{3}{2} \sin 2x = -\frac{3}{4} + \frac{3x}{4\pi}$ $y = -\frac{3}{4} + \frac{3x}{4\pi}$ Bilangan penyelesaian = 3 Number of solutions	6	8
5	$4x + 4(x + 5) + 4y = 154$ ① $2(x \times y) + 2[x \times (x + 5)] + 2[y \times (x + 5)] = 845$ ② $\text{①} \Rightarrow 8x + 4y = 134$ $y = 33.5 - 2x$ ③ $\text{①} \Rightarrow 2xy + 2x^2 + 10x + 2xy + 10y = 845$ $2x^2 + 4xy + 10x + 10y = 845$ ④ Ganti/Substitute ③ ke dalam/into ④ $2x^2 + 4x(33.5 - 2x) + 10x + 10(33.5 - 2x) = 845$ $2x^2 + 134x - 8x^2 + 10x + 335 - 20x - 845 = 0$ $-6x^2 + 124x - 510 = 0$ $3x^2 - 62x + 255 = 0$ $(3x - 17)(x - 15) = 0$ $x = 5.667, 15$ $x = 5.667 ; y = 33.5 - 2(5.667) = 22.166$ $(x > y)$ $x = 15 ; y = 33.5 - 2(15) = 3.5$ $\therefore x = 15 \text{ cm} ; y = 3.5 \text{ cm}$ $V = 15 \times (15 + 5) \times 3.5 = 1\,050 \text{ cm}^3$ 1 L tepung susu formula dapat dibungkus di dalam bekas tersebut kerana $1 \text{ L} < 1\,050 \text{ cm}^3$. 1 L of formula milk powder can be packed in the container because $1 \text{ L} < 1\,050 \text{ cm}^3$.	8	8
6	(a) $\sqrt{h^2 + 8^2} // \sqrt{50^2 + k^2}$ $\sqrt{h^2 + 8^2} = \sqrt{50^2 + k^2}$ $k = \sqrt{h^2 - 2\,436}$ (b) $\frac{y - 10}{x - (-100)} = \frac{5 - 10}{-60 - (-100)}$ $y - 10 = -\frac{1}{8}(x + 100)$ $y = -\frac{1}{8}x - \frac{5}{2}$ $k = \sqrt{(50)^2 - 2\,436}$ $= -8, 8$ $x = 50, y = -8$	3	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	$y \neq -\frac{1}{8}(50) - \frac{5}{2}$ $-8 \neq -\frac{35}{4}$ Kedudukan pusat sukan tidak segaris dengan fakulti kejuruteraan dan fakulti sains apabila nilai $h = 50$. <i>The position of the sports center is not in line with the engineering faculty and the science faculty when the value of $h = 50$.</i>	5	8
7	(a) $\int_0^1 (x^2 + k) dx = \frac{4}{3}$ $\left[\frac{x^3}{3} + kx \right]_0^1 = \frac{4}{3}$ $\left[\frac{(1)^3}{3} + k(1) \right] - \left[\frac{(0)^3}{3} + k(0) \right] = \frac{4}{3}$ $\frac{1}{3} + k = \frac{4}{3}$ $k = 1$ (b) Isi padu kisaran/Volume of revolution $= \pi(1)^2(2) - \pi \left[\frac{y^2}{2} - y \right]_1^2$ $= 2\pi - \pi \left[\left(\frac{2^2}{2} - 2 \right) - \left(\frac{1^2}{2} - 1 \right) \right]$ $= 2\pi - \frac{1}{2} \pi$ $= \frac{3}{2} \pi$	3	8
8	(a) $\overrightarrow{KM} = \overrightarrow{KO} + \overrightarrow{OM}$ $= (5\hat{i} - 3\hat{j}) + (4\hat{i} - 3\hat{j})$ $= 9\hat{i} - 6\hat{j}$ $\overrightarrow{LN} = \overrightarrow{LO} + \overrightarrow{ON}$ $= (4\hat{i} + 2\hat{j}) + 4\hat{j}$ $= 4\hat{i} + 6\hat{j}$ (b) (i) $\overrightarrow{NP} = \left(\frac{1}{1+\lambda} \right) \overrightarrow{NL}$ $\overrightarrow{OP} = \overrightarrow{ON} + \overrightarrow{NP}$ $= 4\hat{j} + \left(\frac{1}{1+\lambda} \right) (-4\hat{i} - 6\hat{j})$ (ii) $\overrightarrow{PM} = \left(\frac{\mu}{1+\mu} \right) \overrightarrow{KM}$ $= \left(\frac{\mu}{1+\mu} \right) (9\hat{i} - 6\hat{j})$	3	3

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks														
	(c) $LP = PN$, maka $\lambda = 1$ $\overrightarrow{OP} = -2\hat{i} + \hat{j}$ $\overrightarrow{PM} = \overrightarrow{PO} + \overrightarrow{OM}$ $\left(\frac{\mu}{1 + \mu}\right)(9\hat{i} - 6\hat{j}) = (2\hat{i} - \hat{j}) + (4\hat{i} - 3\hat{j})$ $\left(\frac{\mu}{1 + \mu}\right)(9\hat{i} - 6\hat{j}) = 6\hat{i} - 4\hat{j}$ $9\mu\hat{i} - 6\mu\hat{j} = (1 + \mu)(6\hat{i} - 4\hat{j})$ $9\mu\hat{i} - 6\mu\hat{j} = 6\hat{i} - 4\hat{j} + 6\mu\hat{i} - 4\mu\hat{j}$ $9\mu\hat{i} - 6\mu\hat{j} = (6 + 6\mu)\hat{i} + (-4 - 4\mu)\hat{j}$ $9\mu = 6 + 6\mu$ $3\mu = 6$ $\mu = 2$	4	10														
9	(a) (i) $\min/\text{mean} = \frac{4}{5} \times 10 = 8$ $\sigma = \sqrt{10\left(\frac{4}{5}\right)\left(\frac{1}{5}\right)} = 1.2649$ (ii) $P(X \geq 3) = 1 - P(X < 3)$ $= 1 - P(X = 0) - P(X = 1) - P(X = 2)$ $= 1 - {}^{10}C_0\left(\frac{4}{5}\right)^0\left(\frac{1}{5}\right)^{10} - {}^{10}C_1\left(\frac{4}{5}\right)^1\left(\frac{1}{5}\right)^9 - {}^{10}C_2\left(\frac{4}{5}\right)^2\left(\frac{1}{5}\right)^8$ $= 0.9999$ (b) (i) $P(X \leq 965) = P\left(Z \leq \frac{965 - 985}{10}\right)$ $= P(Z \leq -2)$ $= 0.0228$ (ii) $P(X \geq k) = \frac{16\,000}{20\,000}$ $P\left(Z \leq \frac{k - 985}{10}\right) = 0.8$ $\frac{k - 985}{10} = -0.842$ $k = 976.58$	5	10														
10	(a) <table><tr><th>u^2</th><th>uv</th></tr><tr><td>0.25</td><td>7.80</td></tr><tr><td>1.00</td><td>7.30</td></tr><tr><td>2.25</td><td>6.30</td></tr><tr><td>4.00</td><td>5.00</td></tr><tr><td>6.25</td><td>3.25</td></tr><tr><td>9.00</td><td>1.26</td></tr></table>	u^2	uv	0.25	7.80	1.00	7.30	2.25	6.30	4.00	5.00	6.25	3.25	9.00	1.26		
u^2	uv																
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2.25	6.30																
4.00	5.00																
6.25	3.25																
9.00	1.26																

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(b) (i) $u = \sqrt{6} \rightarrow u^2 = 6$ $uv = 3.5$ $v = \frac{3.5}{\sqrt{6}}$ $v = 1.43$ (ii) $m = \frac{8-2}{8-0} = 0.75$ $c = 8.0$ $Y = 0.75X + 8$ $uv = 0.75u^2 + 8$ $v = 0.75u + \frac{8}{u}$	5	
11	(a) $\sin \angle AOX = \frac{5}{8}$ $\angle AOX = 0.675 \text{ rad (Tertunjuk/Shown)}$ (b) $\angle AOB = 1.350 \text{ rad}$ $\angle OAX = \angle OBX = \frac{3.142 - 1.350}{2} = 0.896$ $\angle CBX = \angle DAX$ $= 3.142 - 0.896$ $= 2.246 \text{ rad}$	2	10

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	Perimeter $= 2[13(1.350) + 2(5)(2.246)]$ $= 80.02 \text{ cm}$ (c) Luas segi tiga OAB/Area of triangle OAB $= 2 \times \frac{1}{2} (5) (\sqrt{8^2 - 5^2})$ $= 31.225$ Luas sektor OFE Area of sector OFE $= \frac{1}{2} (13)^2 (1.350)$ $= 114.075 \text{ cm}^2$ Luas sektor EAX = Luas sektor FBX Area of sector EAX = Area of sector FBX $= \frac{1}{2} (5)^2 (2.246)$ $= 28.075 \text{ cm}^2$ Luas kawasan berlorek Area of shaded region $= 2[114.075 - 31.225 - 2(28.075)]$ $= 53.40 \text{ cm}^2$	4	10
12	(a) I: $x + y \leq 65$ II: $y \leq 8x$ III: $y - x > 30$ (b) 	3	

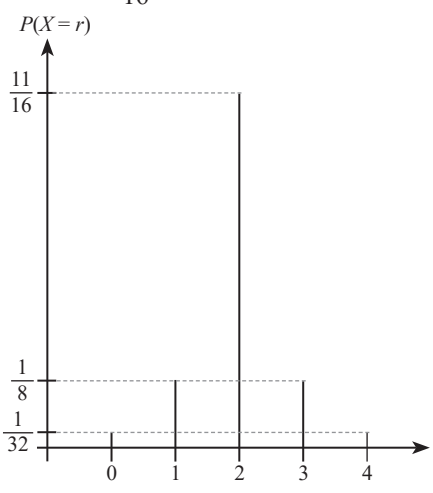
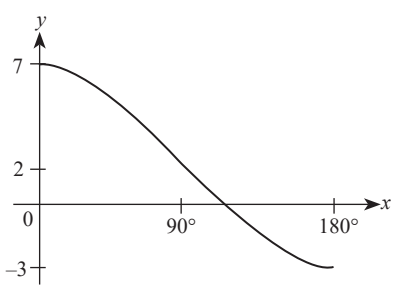
KERTAS MODEL SIJIL PELAJARAN MALAYSIA 2026 (SET 3)

KERTAS 1

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
1	(a) $T(x, y) \rightarrow (x + y, x - 2y)$ $T(2, 1) = (2 + 1, 2 - 2)$ $= (3, 0)$ $T(3, 0) = (3 + 0, 3 - 0)$ $= (3, 3)$ (b) $T(x, y) = (1, 7)$ $x + y = 1$ $x = 1 - y$ $x - 2y = 7$ $1 - y - 2y = 7$ $-3y = 6$ $y = -2$ $x = 1 - (-2)$ $= 3$ $\therefore D(3, -2)$	2 2	4
2	(a) $x^2 - 3x - 7 \leq 3$ $-3 \leq x^2 - 3x - 7 \leq 3$ $x^2 - 3x - 7 \leq 3$ $x^2 - 3x - 10 \leq 0$ $-2 \leq x \leq 5$ $x^2 - 3x - 7 \geq -3$ $x^2 - 3x - 4 \geq 0$ $x \leq -1, x \geq 4$ (b) $\frac{1}{2}x^2 + qx + q = 0$ $q^2 - 4\left(\frac{1}{2}\right)(q) < 0$ $q^2 - 2q < 0$ $q(q - 2) < 0$ $0 < q < 2$ (Terbukti/Shown)	3 3	6
3	(a) $n = \frac{3 - 1}{0 - 4} = -\frac{1}{2}$ $y = kx^n$ $\log_{10} y = \log_{10} k + n \log_{10} x$ $\log_{10} k = 3$ $k = 1\,000$ (b) $\frac{\log_{10} y - 3}{\log_{10} y - 0} = -\frac{1}{2}$ $2 \log_{10} y - 6 = -\log_{10} y$ $3 \log_{10} y = 6$ $\log_{10} y = 2$ $y = 10^2$ $y = 100$	3 2	5

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
4	(a) $a + 17d = 2(a + 8d)$ $d = a$ $\frac{S_{18}}{S_9} = \frac{\frac{18}{2}(2a + 17d)}{\frac{9}{2}(2a + 8d)}$ $= \frac{9(2a + 17d)}{9(2a + 4d)}$ $= \frac{19a}{5a}$ $= \frac{19}{5}$ (b) $S_{10} = \frac{10}{2}(T_{21} + T_{30}) = 675$ $\frac{10}{2}[a + 20d + a + 29d] = 675$ $2a + 49d = 135 \dots\dots\dots ①$ $T_{10} = 21$ $a + 9d = 21 \quad (\times 2)$ $2a + 18d = 42 \dots\dots\dots ②$ $① - ② : 31d = 93$ $d = 3$ $a + 9d = 21$ $a + 9(3) = 21$ $a = -6$ $S_{10} = \frac{10}{2}[2(-6) + 9(3)] = 75$	3	
5	(a) ${}^6C_4 \times {}^5C_3 \times 7!$ $= 756\,000$ (b) ${}^6C_4 \times {}^5C_3 \times 4! \times 4!$ $= 86\,400$ (c) ${}^6C_4 \times {}^5C_3 \times 3! \times 4! \times {}^5C_3$ $= 21\,600$	2 2 2	6
6	Biarkan/Let $\log_a b = x$ $b = a^x$ $\log b = x \log a$ $x = \frac{\log b}{\log a}$ $\log_a b = \frac{\log b}{\log a}$ (Terbukti/Shown) $\log_2 5 \times \log_{11} 4 \times \log_5 11$ $= \frac{\log_{10} 5}{\log_{10} 2} \times \frac{\log_{10} 4}{\log_{10} 11} \times \frac{\log_{10} 11}{\log_{10} 5}$ $= 2$	6	6

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
7	$\frac{1}{2}(AT)(10) = 60$ $AT = 12 \text{ cm}$ $\tan \angle AOT = \frac{12}{10}$ $\angle AOT = 50.19^\circ$ $= 50.19 \times \frac{\pi}{180^\circ}$ $= 0.876 \text{ rad}$ Luas sektor / Area of sector AOB $= \frac{1}{2}(10)^2(0.876)$ $= 43.80 \text{ cm}^2$	6	6
8	$y = \frac{k}{x^2} + h$ $3 = \frac{k}{1^2} + h$ $k + h = 3 \text{ ①}$ $\frac{\int_1^2(kx^{-2} + h) dx}{\int_2^4(kx^{-2} + h) dx} = \frac{3}{4}$ $4\left[-\frac{k}{x} + hx\right]_1^2 = 3\left[-\frac{k}{x} + hx\right]_2^4$ $4\left[\left(-\frac{k}{2} + h(2)\right) - \left(-\frac{k}{1} + h(1)\right)\right] = 3\left[\left(-\frac{k}{4} + h(4)\right) - \left(-\frac{k}{2} + h(2)\right)\right]$ $2k + 4h = \frac{3k}{4} + 6h$ $h = \frac{5k}{8} \text{ ②}$ Gantikan ② dalam ① Substitute ② into ① $k + \frac{5k}{8} = 3$ $k = \frac{24}{13}$ $\frac{24}{13} + h = 3$ $h = \frac{15}{13}$	6	6
9	(a) $P(X < 58)$ $= P\left(Z < \frac{58 - 54}{7}\right)$ $= P(Z < 0.571)$ $= 0.716$	1	1

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(b) $P(X-2) = 1 - \frac{2}{32} - \frac{2}{8}$ $= \frac{11}{16}$ 	3	4
10	(a) $a = 2$ $b = 4$ $c = \frac{1}{2}$ (b) 	3 3	6
11	(a) $\text{Luas/Area} = \frac{1}{2} \begin{vmatrix} 0 & -3 & 6 & 0 \\ 0 & -4 & 2 & 0 \end{vmatrix} - 24$ $= \frac{1}{2} 0 + (-6) + 0 - [0 + (-24) + 0]$ $= \frac{1}{2} 18$ $= 9 \text{ unit}^2/\text{units}^2$ (b) $x = \frac{2(-3) + 3(6)}{5}$ $= \frac{12}{5}$ $y = \frac{3(2) + 2(-4)}{5}$ $= -\frac{2}{5}$ $\therefore C\left(\frac{12}{5}, -\frac{2}{5}\right)$	2 2	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(c) $PA = 2PB$ $\sqrt{(x+3)^2 + (y+4)^2} = 2\sqrt{(x-6)^2 + (y-2)^2}$ $x^2 + 6x + 9 + y^2 + 8y + 16 = 4x(x^2 - 12x + 36 + y^2 - 4y + 4)$ $3x^2 + 3y^2 - 54x - 24y + 135 = 0$ $x^2 + y^2 - 18x - 8y + 45 = 0$	2	6
12	$h - k + 1 = 0$, $h = k - 1$ ① $3h + k = 0$ ② Gantikan ① dalam ② Substitute ① into ② $3(k - 1) + k = 0$ $3k - 3 + k = 0$ $4k = 3$ $k = \frac{3}{4}$ Gantikan dalam / Substitute into ① $h = \frac{3}{4} - 1$ $= -\frac{1}{4}$	3	3
13	(a) $3kx + 2y - 6z = 2$ ① $qx + 2y - 8z = 7$ ② $3x - 2z = 12$ ③ ② - ① : $(q - 3k)x - 2z = 5$ ④ ③ - ④ : $3 - (q - 3k) = 7$ $-q + 3k = 4$ $-q = 4 - 3k$ $q = 3k - 4$ (b) $\sqrt{k+1} + \sqrt{k-4} = \sqrt{2k+9}$ $[(\sqrt{k+1}) + (\sqrt{k-4})]^2 = (\sqrt{2k+9})^2$ $(k+1) + (k-4) + 2\sqrt{k+1}\sqrt{k-4} = 2k+9$ $2k-3 + 2\sqrt{(k+1)(k-4)} = 2k+9$ $2\sqrt{(k+1)(k-4)} = 12$ $4(k+1)(k-4) = 144$ $(k+1)(k-4) = 36$ $k^2 - 3k - 4 = 36$ $k^2 - 3k - 40 = 0$ $(k-8)(k+5) = 0$ $k = 8, k = -5$ $\therefore k = 8$	5	8
14	(a) (i) $y = \frac{1}{x} + 2\sqrt{x}$ $= x^{-1} + 2x^{\frac{1}{2}}$ $\frac{dy}{dx} = -\frac{1}{x^2} + 2\left(\frac{1}{2}\right)x^{-\frac{1}{2}}$ $= -\frac{1}{x^2} + \frac{1}{\sqrt{x}}$		

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
1	(a) $y = 8x^{-2}$ $\frac{dy}{dx} = -\frac{16}{x^3}$ $y = 1$ $x^2 = 8$ $x = \sqrt{8}$ $\frac{\delta y}{\delta x} = \frac{dy}{dx}$ $\frac{h}{\delta x} = -\frac{16}{8\sqrt{8}}$ $= -\frac{16}{16\sqrt{2}}$ $\delta x = -\sqrt{2}h$ (b) $y = (x + 1)^2$ $y = x^2 + 2x + 1$ $\delta y + y = (x + \delta x)^2 + 2(x + \delta x) + 1$ $\delta y + x^2 + 2x + 1 = x^2 + 2\delta x(x) + (\delta x)^2 + 2x + 2\delta x + 1$ $\delta y = 2\delta x(x) + (\delta x)^2 + 2\delta x$ $\frac{\delta y}{\delta x} = 2x + \delta x + 2$ $\frac{dy}{dx} = \lim_{\delta x \rightarrow 0} \frac{\delta y}{\delta x}$ $= \lim_{\delta x \rightarrow 0} (2x + \delta x + 2) = 2x + 2$	3	
2	(a) $b^2 - 4ac < 0$ $(-4)^2 - 4(-1)c < 0$ $16 + 4c < 0$ $c < -4$ (b) $y = x^2 + (k-1)x - k$ $y = 0$, $b^2 - 4ac = 0$ $(k-1)^2 - 4(1)(-k) = 0$ $k^2 - 2k + 1 + 4k = 0$ $k^2 + 2k + 1 = 0$ $(k+1)^2 = 0$ $k = -1$	3	6
3	$6 + 66 + 666 + 6666 + \dots$ $\frac{2}{3}[9 + 99 + 999 + \dots]$ $S_n = \frac{2}{3}[(10 - 1) + (10^2 - 1) + \dots + (10^n - 1)]$ $= \frac{2}{3}[10^1 + 10^2 + 10^3 + \dots + 10^n] + \frac{2}{3}[-1 - 1 - 1 \dots - 1]$ $= \frac{2}{3}(10)\left(\frac{10^n - 1}{10 - 1}\right) - \frac{2}{3}n$ $= \frac{20}{27}(10^n - 1) - \frac{2}{3}n$	7	7

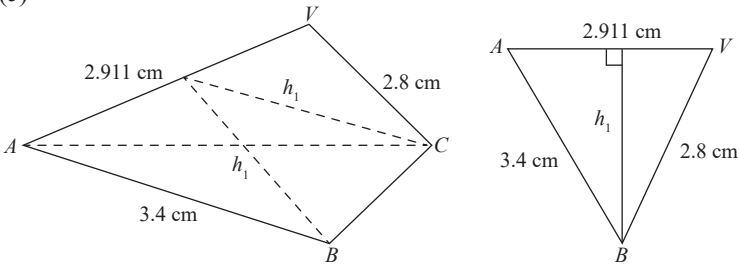
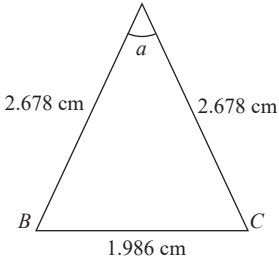
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
4	(a) $s = \theta r$ $6.2 = \theta \times 5$ $\theta = 1.24 \text{ rad}$ $\angle BAD = \frac{1}{2}(1.24) = 0.62$ $\sin 0.62 = \frac{BD}{5}$ $BD = 5 \sin 0.62$ $BD = 2.905 \text{ cm}$ $s = \theta r$ $= (2.905)(\pi)$ $= 9.126 \text{ cm}$ Perimeter $= 9.126 + 6.2$ $= 15.326 \text{ cm}$ (b) Luas semi bulatan BCF/Area of semicircle $BCF = \frac{1}{2}\pi r^2$ $= \frac{1}{2}\pi(2.905)^2$ $= 13.256 \text{ cm}$ Luas segmen BCE/Area of segment $BCE = \frac{1}{2}r^2(\theta - \sin \theta)$ $= \frac{1}{2}(5)^2(1.24 - \sin 1.24)$ $= 3.678 \text{ cm}$ Luas kawasan berlorek/Area of shaded region $= 13.256 - 3.678$ $= 9.578 \text{ cm}$	4 3	7
5	(a) $\overrightarrow{AB} = \underline{b} - \underline{a}$ $\overrightarrow{AD} = \frac{1}{2}\underline{b} - \frac{1}{2}\underline{a}$ $\overrightarrow{OD} = \overrightarrow{OA} + \overrightarrow{AD}$ $= \underline{a} + \frac{1}{2}\underline{b} - \frac{1}{2}\underline{a}$ $= \frac{1}{2}\underline{a} + \frac{1}{2}\underline{b}$ $\overrightarrow{OM} = \overrightarrow{POD}$ $= p\left(\frac{1}{2}\underline{a} + \frac{1}{2}\underline{b}\right)$ $= \frac{1}{2}p\underline{a} + \frac{1}{2}p\underline{b}$ $\overrightarrow{BC} = \frac{2}{3}\underline{a} - \underline{b}$ $\overrightarrow{BM} = q\overrightarrow{BC}$ $= q\left(\frac{2}{3}\underline{a} - \underline{b}\right)$ $\overrightarrow{OM} = \overrightarrow{OB} + \overrightarrow{BM}$ $= \underline{b} + q\left(\frac{2}{3}\underline{a} - \underline{b}\right)$ $= (1 - q)\underline{b} + \frac{2}{3}q\underline{a}$	5	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks								
	(b) $\frac{1}{2}p = \frac{2}{3}q$ $p = \frac{4}{3}q \text{ ①}$ $\frac{1}{2}p = 1 - q \text{ ②}$ Gantikan ① dalam ② Substitute ① into ② $\frac{1}{2}\left(\frac{4}{3}q\right) = 1 - q$ $\frac{5}{3}q = 1$ $q = \frac{3}{5}$ $p = \frac{4}{3}\left(\frac{3}{5}\right)$ $= \frac{4}{5}$	3	8								
6	$f(x) = \frac{x}{x+1}$ $f^2(x) = \frac{\frac{x}{x+1}}{\frac{x}{x+1} + 1}$ $= \frac{x}{2x+1}$ $f^3(x) = f[f^2(x)]$ $= f\left(\frac{x}{2x+1}\right)$ $= \frac{x}{3x+1}, x \neq -\frac{1}{3}$ $f^n(x) = \frac{x}{nx+1}, x \neq -\frac{1}{n}$	7	7								
7	(a), (b) <table border="1" data-bbox="736 1338 965 1466"> <tr> <td>x</td><td>$\frac{\pi}{2}$</td><td>π</td><td>2π</td></tr> <tr> <td>y</td><td>3</td><td>2</td><td>$\frac{3}{2}$</td></tr> </table> 2 penyelesaian/solutions	x	$\frac{\pi}{2}$	π	2π	y	3	2	$\frac{3}{2}$	4	
x	$\frac{\pi}{2}$	π	2π								
y	3	2	$\frac{3}{2}$								

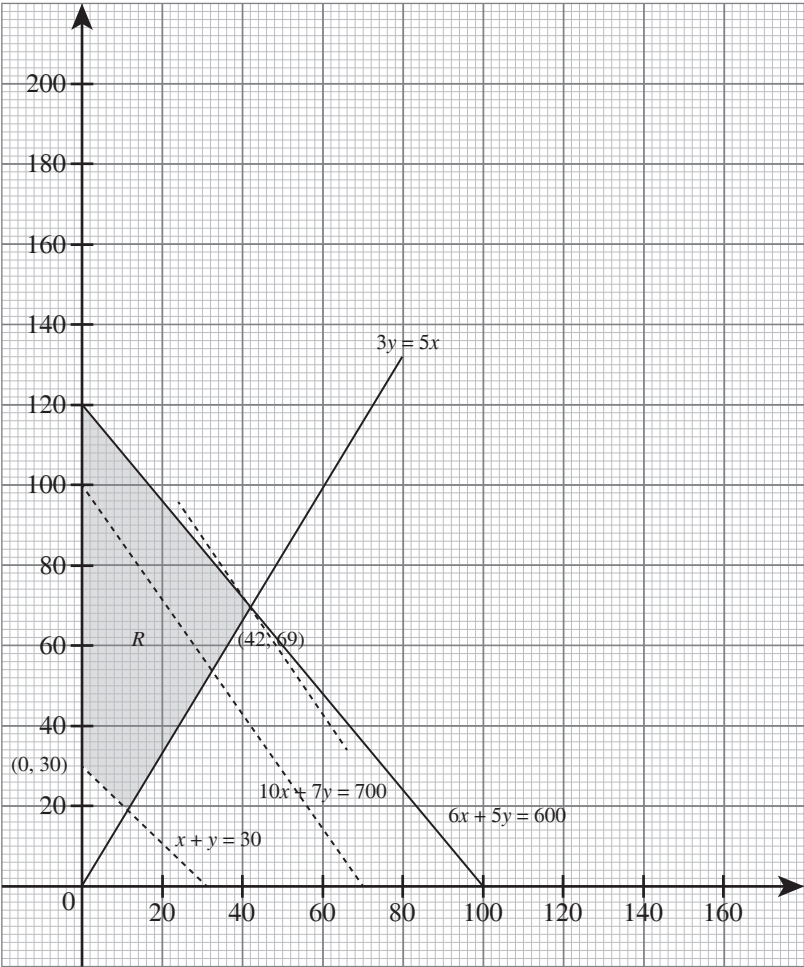
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	$\frac{\pi}{x} + 3 \tan \frac{3}{2}x = 1$ $\frac{\pi}{x} + 1 + 3 \tan \frac{3}{2}x = 2$ $\frac{\pi}{x} + 1 = 2 - 3 \tan \frac{3}{2}x$ $y = \frac{\pi}{x} + 1$	4	8
8	(a) $\frac{y-8}{y-9} = \frac{8-2}{9+3}$ $\frac{y-8}{y-9} = \frac{6}{12}$ $2y - 16 = y - 9$ $y = 7$ Pintasan-y/ <i>y-intercept</i> = 7 (b) Titik tengah <i>AB</i> / <i>Midpoint of AB</i> $= \left(\frac{-3+9}{2}, \frac{2+8}{2} \right) = (3, 5)$ (c) $m_1 m_2 = -1$, $\frac{1}{2} m_2 = -1$ $m_2 = -2$ $y - 5 = -2(x - 3)$ $y = -2x + 11$ (d) (i) $E(0, 11)$ (ii) Luas <i>ABE</i> / <i>Area ABE</i> $= \frac{1}{2} \begin{vmatrix} -3 & 9 & 0 & -3 \\ 2 & 8 & 11 & 2 \end{vmatrix}$ $= \frac{1}{2} -24 + 99 + 0 - 18 - 0 + 33 $ $= \frac{1}{2} 90 $ $= 45 \text{ unit}^2 / \text{units}^2$ Luas <i>ECD</i> / <i>Area ECD</i> $= \frac{1}{2} \begin{vmatrix} 0 & 3 & 0 & -3 \\ 7 & 5 & 11 & 7 \end{vmatrix}$ $= \frac{1}{2} 0 + 33 + 0 - 21 - 0 + 33 $ $= \frac{45}{2} \text{ unit}^2 / \text{units}^2$ $\frac{\text{Luas } ABE / \text{Area } ABE}{\text{Luas } ECD / \text{Area } ECD} = \frac{45}{\left(\frac{45}{2}\right)}$ Luas <i>ABE</i> = 2 kali luas <i>ECD</i> <i>Area ABE</i> = 2 times area <i>ECD</i>	1 1 2 4	8

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No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	Isi padu / Volume $B = \frac{1}{3} (2\pi)$ $\pi \left[\frac{x^2}{2} + x \right]_1^k = \frac{2}{3} \pi$ $\left(\frac{k^2}{2} + k \right) - \left(\frac{3}{2} \right) = \frac{2}{3}$ $3k^2 + 6k - 9 = 4$ $3k^2 + 6k - 13 = 0$ $k = \frac{-6 \pm \sqrt{36 - 4(3)(-13)}}{3}$ $= \frac{-6 \pm \sqrt{192}}{6}$ $k > 0, k = \frac{-6 \pm \sqrt{192}}{6}$ $= \frac{-3 + 4\sqrt{3}}{3}$ (b) (i) $\frac{1}{2}(6) = 3$ (ii) $[3x]_0^4 - 6$ $= 12 - 0 - 6$ $= 6$	6	8
11	(a) (i) $X = B(n, p)$ $np = 40, \quad npq = 15$ $40q = 15$ $q = 0.375$ $p = 1 - 0.375$ $= 0.625$ (ii) $X =$ ciku yang elok / <i>cikus that are good</i> $p = \frac{3}{5} = 0.6, \quad q = \frac{2}{5} = 0.4, \quad n = 8,$ $P(X \geq 2)$ $= 1 - P(X = 0) - P(X = 1)$ $= 1 - {}^8C_0 (0.6)^8 (0.4)^0 - {}^8C_1 (0.6)^7 (0.4)^1$ $= 1 - 0.0168 - 0.0896$ $= 0.8936$ (b) $X =$ markah / <i>marks</i>, $X = N(45, 12^2)$ (i) $P(40 < X < 60)$ $= P\left(\frac{40 - 45}{12} < Z < \frac{60 - 45}{12}\right)$ $= (-0.417 < Z < 1.25)$ $= 1 - A(0.417) - A(1.25)$ $= 1 - 0.3384 - 0.1056$ $= 0.556$ Bilangan murid <i>Number of students</i> $= 40(0.556)$ $= 22.24$ $= 22$	4	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(c)  $s = \frac{3.4 + 2.911 + 2.8}{2}$ $= 4.5555 \text{ m}$ $\text{Luas } VAB / \text{Area } VAB = \sqrt{(4.5555)(1.1555)(1.6445)(1.7555)}$ $= 3.898 \text{ m}^2$ $\frac{1}{2} (2.911)(h_1) = 3.898$ $h_1 = 2.678 \text{ m}$ $h_1 = h_2 = 2.678 \text{ m}$  $1.986^2 = 2.678^2 + 2.678^2 - 2(2.678)^2 \cos / \cos \alpha$ $\cos / \cos \alpha = 0.7250$ $\alpha = 43.53^\circ$	5	10
13	(a) (i) $y = 130$ (ii) $\frac{3.90}{x} \times 100 = 130$ $x = \text{RM}3.00$ $z = \frac{4.80}{3.20} \times 100$ $= 150$ (b) $I = \frac{108(6) + 130(5) + 170(3) + 150(1)}{6 + 5 + 3 + 1}$ $= 130.5$ (c) (i) $160 = \frac{130.5 \times I}{100}$ $I = 122.6$ (ii) $112.6 = \frac{Q_1}{2.40} \times 100$ $Q_1 = \text{RM}2.94$	3	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	Bahagian maksimum bahan pencuci yang boleh dihasilkan <i>Maximum number of detergent that can be produced</i> $= \frac{\text{RM}195\,000}{\text{RM}2.94}$ $= 66\,327 \text{ botol/bottles}$	5	10
14	(a) $v = 3t^2 - 15t + 12$ $3t^2 - 15t + 12 > 0$ $t^2 - 5t + 4 > 0$ $(t-1)(t-4) > 0$ $0 \leq t < 1 \text{ saat / second}$ $t > 4 \text{ s}$ (b) $a = 6t - 15$ $6t - 15 > 0$ $t > \frac{5}{2} \text{ s}$ (c) $v = 0$ $t = 1 \text{ s} \quad t = 4 \text{ s}$ $s = \int (3t^2 - 15t + 12) dt$ $= t^3 - \frac{15}{2}t^2 + 12t + c$ $t = 0, \quad s = 0, \quad c = 0$ Jarak antara A dan B <i>Distance between A and B</i> $= (1 - \frac{15}{2} + 12) - (64 - 120 + 48)$ $= 5.5 - (-8)$ $= 13.5$ $= 13.5 \text{ m}$	4 3 3	10
15	(a) I: $x + y > 30$ II: $6x + 5y \leq 600$ III: $5x \leq 3y$	3	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(b)  (c) Katakan/Let $k = 700$ Apabila/when $(0, 30)$ Jualan / Sales $= 10(0) + 7(30)$ $= \text{RM}210$ Apabila/When $(42, 69)$ Jualan / Sales $= 10(42) + 7(69)$ $= \text{RM}903$ Julat jualan, J / Range of sales, J: $210 < J \leq 903$	3 4	10

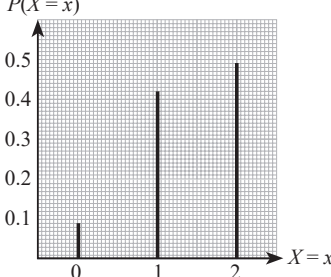
KERTAS MODEL SIJIL PELAJARAN MALAYSIA 2026 (SET 4)

KERTAS 1

Bahagian A

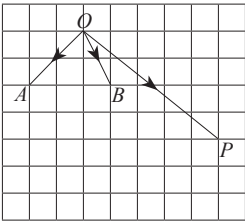
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
1	(a) (i) $\{1, 2, 3, 4, 5\}$ (ii) 2, 4, 8	1 1	7
	(b) (i) $f(0) = h$ $ 5 - 0 = h$ $h = 5$ $f\left(\frac{5}{8}\right) = 0$ $\left 5 - \frac{5}{8}k\right = 0$ $5 - \frac{5}{8}k = 0$ $-\frac{5}{8}k = -5$ $k = 8$	1 1	
	(ii) $0 \leq f(x) \leq 13$	1	
	(iii) $f(x)$ mempunyai fungsi songsang kerana fungsi ini mempunyai hubungan satu kepada satu. <i>$f(x)$ has an inverse function because it is one-to-one relation.</i>	1	
2	(a) $1 - 6x = 0$ $x = \frac{1}{6}$	1	4
	(b) Anggap / Let $y = f^{-1}(x)$ $f(y) = x$ $\frac{p}{1 - 6y} = x$ $p = x(1 - 6y)$ $p = x - 6xy$ $6xy = x - p$ $y = \frac{x - p}{6x}$ $y = \frac{1}{6} - \frac{p}{6x}$ $f^{-1}(x) = \frac{1}{6} - \frac{p}{6x}$	1	
	Maka / Then, $-\frac{p}{6} = -\frac{2}{q}$ $\frac{p}{6} = \frac{2}{q}$ $p = \frac{12}{q}$	1	
3	$y = 3(x - b)^2 + a$ $y = 3(x - b)(x - b) + a$ $y = 3(x^2 - bx - bx + b^2) + a$ $y = 3(x^2 - 2bx + 3b^2) + a$ $y = 3x^2 - 6bx + 3b^2 + a$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	Guna / Use $b^2 - 4ac > 0$ $(-6b)^2 - 4(3)(3b^2 + a) > 0$ $36b^2 - 36b^2 - 12a > 0$ $-12a > 0$ $a < \frac{0}{-12}$ $a < 0$; tertunjuk / shown	1 1	3
4	(a) $(x-3)^2 = x-5$ $x^2 - 6x + 9 - x + 5 = 0$ $x^2 - 7x + 14 = 0$ $b^2 - 4ac = (-7)^2 - 4(1)(14)$ $= -7 < 0$ $\therefore b^2 - 4ac < 0$ (Tiada punca nyata / No real roots)	1 1	6
	(b) $x(x-m) = 3-k$ $x^2 - mx + k - 3 = 0$ Punca / Roots: $\alpha, \alpha + 8$ HTP / SOR: $\alpha + (\alpha + 8) = -\left(-\frac{m}{1}\right)$ $2\alpha + 8 = m$ $\alpha = \frac{m-8}{2}$ HDP / POR: $\alpha(\alpha + 8) = \frac{k-3}{1}$ $\alpha^2 + 8\alpha = k-3$ $\left(\frac{m-8}{2}\right)^2 + 8\left(\frac{m-8}{2}\right) - k + 3 = 0$ $\frac{m^2 - 16m + 64}{4} + 4m - 32 - k + 3 = 0$ $m^2 - 4k - 52 = 0$ $m = \pm \sqrt{52 + 4k}$	1 1 1	
5	(a) $x \log_{27} p = \log_3 p$ $\log_{27} p^x = \log_3 p$ $\frac{\log_3 p^x}{\log_3 27} = \log_3 p$ $\frac{\log_3 p^x}{\log_3 3^3} = \log_3 p$ $\frac{\log_3 p^x}{3} = \log_3 p$ $\log_3 p^x = 3 \log_3 p$ $p^x = p^3$ $x = 3$	1 1 1	6
	(b) $3^{2h-4m} = 5 + 3^{3(2h)}$ $\frac{3^{2h}}{3^{4m}} = 5 + (3^{2h})^3$ $\frac{k}{p} = 5 + k^3$ $\frac{k}{5 + k^3} = p$	1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	$24\,000t^3 = 12\,000$ $t^3 = \frac{12\,000}{24\,000}$ $t^3 = 0.5$ $t = 0.7937 \text{ jam / hours}$ $t \approx 48 \text{ minit / minutes}$ (ii) $P = \frac{12\,000(0.7937)}{1 + 0.7937^3}$ $P = 6\,349.6 \approx 6\,350$	1 1	7
9	(a) $X = \{0, 1, 2\}$ (b) $P(X=0) = {}^2C_0(0.7)^0(0.3)^{2-0} = 0.09$ $P(X=1) = {}^2C_1(0.7)^1(0.3)^{2-1} = 0.42$ $P(X=2) = {}^2C_2(0.7)^2(0.3)^{2-2} = 0.49$ 	1 2 2	5
10	$P(m < Z < 0) = 2P(0 < Z < k)$ $0.5 - 0.14 = 2[0.5 - P(Z > k)]$ $0.18 = 0.5 - P(Z > k)$ $P(Z > k) = 0.5 - 0.18$ $P(Z < k) = 0.32$ $k = 0.468$ $P(Z < m) = P(Z > -m)$ $= 0.14$ $\therefore m = -1.081$	1 1 1 1	4
11	(a) $\int_p^1 \frac{1}{2} [f(x) - x] dx = 20$ $\frac{1}{2} \int_p^1 f(x) dx - \frac{1}{2} \int_p^1 x dx = 20$ $\frac{1}{2} (36) - \frac{1}{2} \left[\frac{x^2}{2} \right]_p^1 = 20$ $18 - \frac{1}{2} \left[\frac{1^2}{2} - \frac{p^2}{2} \right] = 20$ $-\frac{1}{2} \left[\frac{1}{2} - \frac{p^2}{2} \right] = 2$ $\frac{1}{2} - \frac{p^2}{2} = -4$ $-\frac{p^2}{2} = -\frac{9}{2}$ $p^2 = 9$ $p = \pm 3$ Oleh sebab / Since $p < 0$, $p = -3$	1 1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(b) $\int -\frac{r}{(2-qx)^4} dx = -r \int (2-qx)^{-4} dx$ $= -r \frac{(2-qx)^{-3}}{(-3)(-q)} + c$ $= -\frac{r}{3q} (2-qx)^{-3} + c$ $-\frac{r}{3q} = -3$ $\frac{r}{3q} = 3$ $\frac{r}{q} = 9$ Maka / Thus, $r : q = 9 : 1$	1 1 1	7
12	(a) $\sin A = \frac{a}{c}$, $\cos A = \frac{b}{c}$, $\tan A = \frac{a}{b}$ Diketahui bahawa / It is known that, $a^2 + b^2 = c^2$ Bahagi kedua-dua belah dengan b^2 / Divide both sides by b^2: $\frac{a^2}{b^2} + \frac{b^2}{b^2} = \frac{c^2}{b^2}$ $\frac{a^2}{b^2} + 1 = \frac{c^2}{b^2}$ $\left(\frac{a}{b}\right)^2 + 1 = \left(\frac{c}{b}\right)^2$ $\therefore \tan^2 A + 1 = \sec^2 A$	1 1 1	
	(b) $(1 + \tan A)^2 = (1 + \tan A)(1 + \tan A)$ $= 1 + 2 \tan A + \tan^2 A$ $= 1 + \tan^2 A + 2 \tan A$ $= \sec^2 A + 2 \frac{\sin A}{\cos A}$ $= \sec^2 A + 2 \frac{\sin A}{\cos A} \cdot \frac{\cos A}{\cos A}$ $= \sec^2 A + 2 \frac{\sin A \cos A}{\cos^2 A}$ $= \sec^2 A + 2 \sin A \cos A \left(\frac{1}{\cos^2 A}\right)$ $= \sec^2 A + \sin 2A \sec^2 A$ $= \sec^2 A (1 + \sin 2A)$	1 1 1	6

Bahagian B

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
13	(a) (i) 	2	7
	(ii) $\vec{OP} = 3\begin{pmatrix} -1 \\ -4 \end{pmatrix} - \begin{pmatrix} 2 \\ 4 \end{pmatrix}$	1	
	$\vec{OP} = \begin{pmatrix} -5 \\ -16 \end{pmatrix}$	1	
	$ \vec{OP} = \sqrt{(-5)^2 + (-16)^2}$	1	
	$ \vec{OP} = \sqrt{281}$	1	
	(b) $\lambda\left(-\frac{1}{4}hp - 2q\right) = (1-k)p + 2hq$	1	
	$-\frac{1}{4}h\lambda p - 2\lambda q = (1-k)p + 2hq$	1	
	$-\frac{1}{4}h\lambda = 1-k, \quad -2\lambda = 2h$	1	
	$\lambda = -h$	1	
	$-\frac{1}{4}h(-h) = 1-k$ $h^2 = 4(1-k)$ $h = 2\sqrt{1-k}$	1	
14	(a) $P(0, -20)$ dan / and $R(0, 20)$	1	8
		1	
	(b) (i) $\frac{1}{2}(20)^2(\pi) = 200\pi$	1	
	(ii) Diameter semi bulatan OQR / Diameter of semicircle OQR $= \sqrt{20^2 + 20^2} = 20\sqrt{2}$		
	Jejari semi bulatan OQR / Radius of semicircle OQR $= 10\sqrt{2}$	1	
	Luas semi bulatan OQR / Area of semicircle OQR $= \frac{1}{2}(10\sqrt{2})^2(\pi)$ $= 100\pi$	1	
	Luas segi tiga OQR / Area of triangle OQR $= \frac{1}{2}(20)(20)$ $= 200$		
	Luas satu tembereng / Area of one segment $= \frac{100\pi - 200}{2}$ $= 50\pi - 100$	1	
	Luas kawasan berlorek / Area of the shaded region $= 200\pi - (200 + 50\pi - 100)$ $= 150\pi - 100$ $= 50(3\pi - 2)$	1 1	

Bahagian A

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks	
1	Diberi $(6, -4)$ dan kecerunan $\frac{1}{2}$. <i>Given $(6, -4)$ and gradient $\frac{1}{2}$.</i>	1		
	$-4 = m(6) + \frac{1}{2}$			
	$6m = -\frac{9}{2}$	1		
	$m = -\frac{3}{4}$			
	Maka / <i>Thus</i> , $y = -\frac{3}{4}x + \frac{1}{2}$ ①	1		
	Ganti ① ke dalam / <i>Substitute ① into $x^2 + xy - 6 = 0$:</i>	1		
	$x^2 + x\left(-\frac{3}{4}x + \frac{1}{2}\right) - 6 = 0$			
	$x^2 - \frac{3}{4}x^2 + \frac{1}{2}x - 6 = 0$			
	$\frac{1}{4}x^2 + \frac{1}{2}x - 6 = 0$			
	$\frac{1}{4}(x + 6)(x - 4) = 0$	1		
	$x = -6, x = 4$			
	Pada / <i>At</i> $x = -6$,			2
	$y = -\frac{3}{4}(-6) + \frac{1}{2}$			
	$= 5$			
	Pada / <i>At</i> $x = 4$,			
	$y = -\frac{3}{4}(4) + \frac{1}{2}$	1		
$= -\frac{5}{2}$				
Maka, $A(-6, 5)$ dan $B\left(4, -\frac{5}{2}\right)$.				
<i>Thus, $A(-6, 5)$ and $B\left(4, -\frac{5}{2}\right)$.</i>				
2	(a) $\sqrt{320} - \sqrt{45} = \sqrt{64} \cdot \sqrt{5} - \sqrt{9} \cdot \sqrt{5}$ $= 8\sqrt{5} - 3\sqrt{5}$ $= 5\sqrt{5}$	1		
	Maka / <i>Thus</i> , $a = 5$	1		
	(b) $2^2 = 3^2 + (2 + \sqrt{3})^2 - 2(3)(2 + \sqrt{3}) \cos \theta$ $2^2 - 3^2 - (2 + \sqrt{3})^2 = -2(3)(2 + \sqrt{3}) \cos \theta$ $4 - 9 - (4 + 2\sqrt{3} + 2\sqrt{3} + 3) = -(12 + 6\sqrt{3}) \cos \theta$ $-12 - 4\sqrt{3} = -(12 + 6\sqrt{3}) \cos \theta$	1		

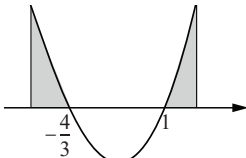
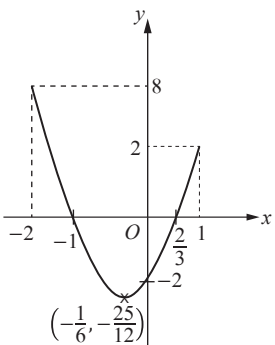
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
4	(a) (i) $\vec{QT} = \vec{QO} + \vec{OT}$ $= -8\vec{a} + 2\vec{b}$	1	
	(ii) $\vec{PS} = \vec{PO} + \vec{OS}$ $= -4\vec{a} + 5\vec{b}$	1	
	(b) (i) $\vec{OR} = \vec{OQ} + \vec{QR}$ $= 8\vec{a} + m(-8\vec{a} + 2\vec{b})$ $= (8 - 8m)\vec{a} + 2m\vec{b}$	1 1	
	(ii) $\vec{OR} = \vec{OS} + \vec{SR}$ $\vec{OR} = \vec{OS} - \vec{RS}$ $= 5\vec{b} - n(-4\vec{a} + 5\vec{b})$ $= 4n\vec{a} + (5 - 5n)\vec{b}$	1	
	(c) Diketahui / It is known that $8 - 8m = 4n$, $2m = 5 - 5n$ $8m = 20 - 20n$	1	8
	$8 - (20 - 20n) = 4n$ $2m = 5 - 5\left(\frac{3}{4}\right)$ $-12 + 20n = 4nm$ $m = \frac{5}{8}$ $16n = 12$ $n = \frac{3}{4}$	1	
		1	
		1	
5	(a) $\theta = \frac{1}{5}\pi$	1	
	Perimeter $= 2r + r\left(\frac{1}{5}\pi\right)$, Luas / Area $= \frac{1}{2}r^2\left(\frac{1}{5}\pi\right)$	1	
	$2r + r\left(\frac{1}{5}\pi\right) = \frac{1}{2}r^2\left(\frac{1}{5}\pi\right)$	1	
	$\left(2 + \frac{1}{5}\pi\right)r = \left(\frac{1}{10}\pi\right)r^2$ $r = \frac{\left(2 + \frac{1}{5}\pi\right)}{\left(\frac{1}{10}\pi\right)}$ $r = 8.365 \text{ cm}$	1	
	(b) Isi padu sepotong kek / Volume per slice of cake $= \pi(8.365)^2(12) \div 10$ $= 263.79 \text{ cm}^3$	1	
	Jisim sepotong kek / Mass per slice of cake $= 263.79 \div 0.916$ $= 287.98 \text{ g}$	1	
	Harga sepotong kek / Price per slice of cake $= \frac{287.98 \text{ g}}{100 \text{ g}} \times \text{RM}4.90$ $= \text{RM}14.11 \text{ sepotong / per slice}$	1	
	Bilangan sepotong kek / Number of slice of cake $= \frac{\text{RM}180}{\text{RM}14.11}$ $= 112.76$ $\approx 12 \text{ potong / slices}$	1	

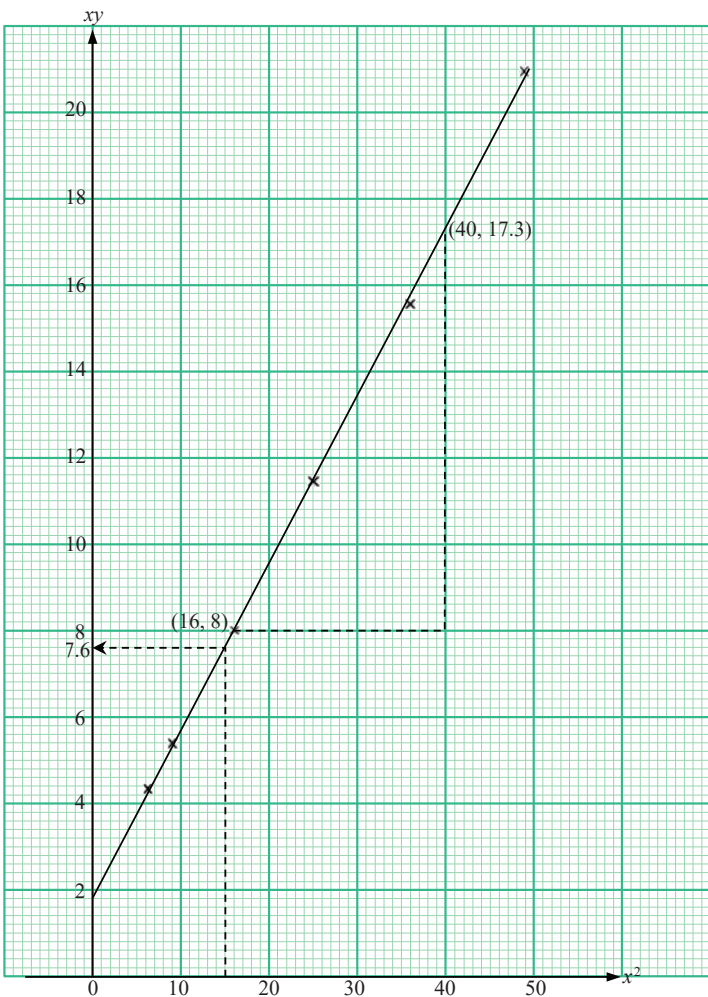
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
6	(a) $T_1 = \frac{1}{2}(b)(h)$ $= \frac{bh}{2}$ $T_2 = \frac{1}{2}(b)(h+1)$ $= \frac{b(h+1)}{2}$ $= \frac{bh+b}{2}$ $T_3 = \frac{1}{2}(b)(h+2)$ $= \frac{b(h+2)}{2}$ $= \frac{bh+2b}{2}$ $T_3 - T_2 = T_2 - T_1$ $\frac{bh+2b}{2} - \frac{bh+b}{2} = \frac{bh+b}{2} - \frac{bh}{2}$ $\frac{b}{2} = \frac{b}{2}$ Beza sepunya / Common difference = $\frac{b}{2}$	1	
		1	
		1	
	(b) $S_9 = \frac{9}{2} \left[2\left(\frac{bh}{2}\right) + (9-1)\left(\frac{b}{2}\right) \right]$ $S_9 = \frac{9}{2} bh + 18b$	1	
		1	
	(c) $T_1 = \frac{1}{3}(b^2)(h)$ $= \frac{b^2h}{3}$ $T_2 = \frac{1}{3}(b^2)(h+1)$ $= \frac{b^2(h+1)}{3}$ $= \frac{b^2h+b^2}{3}$ $T_3 = \frac{1}{3}(b^2)(h+2)$ $= \frac{b^2(h+2)}{3}$ $= \frac{b^2h+2b^2}{3}$		

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	$a = \frac{b^2h}{3}, d = \frac{b^2}{3}$	1	8
	$S_{16} = \frac{16}{2} \left[2 \left(\frac{b^2h}{3} \right) + (16-1) \left(\frac{b^2}{3} \right) \right]$	1	
	$= \frac{16}{3} b^2h + 40b^2$	1	
7	(a) (i) ${}^{10}C_4 = 210$	1	7
	(ii) $({}^3C_2 \times {}^7C_1 \times {}^3C_1) + ({}^3C_3 \times {}^3C_1)$	2	
	$= 66$	1	
	(b) ${}^5C_1 \times {}^2C_1$ atau / or ${}^2P_2 \times {}^3P_1$	1	
	${}^5C_1 \times {}^2C_1 \times {}^2P_2 \times {}^3P_1 \times {}^9P_3$	1	
	$= 30\,240$	1	

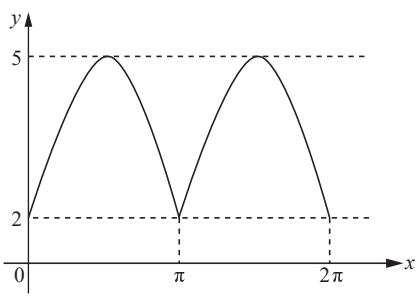
Bahagian B

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
8	(a) HTP / SOR: $p + q = -\frac{1}{\frac{9p}{2}}$	1	
	HDP / POR: $pq = \frac{2q}{\frac{9p}{2}}$		
	$p + q = -\frac{2}{9p}$		
	$9p(p + q) = -2$		
	$9p^2 + 9pq = -2$		
	$pq = \frac{4q}{9p}$		
	$9p^2q = 4q$		
	$9p^2 = 4$		
	$p^2 = \frac{4}{9}$		
	$p = \pm \frac{2}{3}$	1	
	Apabila / When $p = \frac{2}{3}, 9\left(\frac{2}{3}\right)^2 + 9\left(\frac{2}{3}\right)q = -2$		
	$\frac{18}{3}q = -6$		
	$q = -1$		
	Apabila / When $p = -\frac{2}{3}, 9\left(-\frac{2}{3}\right)^2 + 9\left(-\frac{2}{3}\right)q = -2$		
	$-\frac{18}{3}q = -6$		
	$q = -1$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(b) (i) $3x^2 + x - 2 > 2$ $3x^2 + x - 4 > 0$ $(3x + 4)(x - 1) > 0$  $x < -\frac{4}{3}, x > 1$ (ii) $f(x) = 3\left(x^2 + \frac{x}{3} - \frac{2}{3}\right)$ $= 3\left[x^2 + \frac{x}{3} + \left(\frac{1}{6}\right)^2 - \left(\frac{1}{6}\right)^2 - \frac{2}{3}\right]$ $= 3\left[\left(x + \frac{1}{6}\right)^2 - \frac{25}{36}\right]$ $= 3\left(x + \frac{1}{6}\right)^2 - \frac{25}{12}$ Titik minimum / Minimum point $= \left(-\frac{1}{6}, -\frac{25}{12}\right)$ $3x^2 + x - 2 = 0$ $(3x - 2)(x + 1) = 0$ $x = \frac{2}{3}, x = -1$ Pintasan-x / x-intercepts $= \left(\frac{2}{3}, 0\right)$ dan / and $(-1, 0)$ Pada / At $x = -2, y = 3(-2)^2 + (-2) - 2$ $= 8$ Pada / At $x = 1, y = 3(1)^2 + (1) - 2$ $= 2$  Pintasan-x dan pintasan-y / x-intercept and y-intercept: $(-1, 0), \left(\frac{2}{3}, 0\right), (0, -2)$ Titik minimum / Minimum point $= \left(-\frac{1}{6}, -\frac{25}{12}\right)$ Titik / Points $(-2, 8)$ dan / and $(1, 2)$	1 1 1 1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks														
	(c) $-2 + p = -2 - \frac{2}{3}$ dan / and $3q = 3(1)$ $= -\frac{8}{3}$ $= 3$ HTP / SOR $= -\frac{8}{3} + 3$ HDP / POR $= -\frac{8}{3}(3)$ $= \frac{1}{3}$ $= -8$ $\therefore x^2 - \frac{1}{3}x - 8 = 0$	1 1	10														
9	(a) <table border="1"><tr><td>x^2</td><td>6.25</td><td>9</td><td>16</td><td>25</td><td>36</td><td>49</td></tr><tr><td>xy</td><td>4.38</td><td>5.4</td><td>8</td><td>11.5</td><td>15.6</td><td>21</td></tr></table> - Semua titik diplot dengan betul. <i>All points are plotted correctly.</i> - Garis penyuaian terbaik. <i>The line of best fit.</i> 	x^2	6.25	9	16	25	36	49	xy	4.38	5.4	8	11.5	15.6	21	2 1 1	
x^2	6.25	9	16	25	36	49											
xy	4.38	5.4	8	11.5	15.6	21											

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(b) (i) $xy = \frac{b}{a}x^2 + a$ Apabila / When $x^2 = 15$, $xy = 7.6$ $y = \frac{7.6}{\sqrt{15}}$ $y = 1.962$ (ii) $a = 1.9$ $m: \frac{b}{a} = \frac{17.3 - 8}{40 - 16}$ $\frac{b}{1.9} = \frac{17.3 - 8}{40 - 16}$ $\frac{b}{1.9} = \frac{31}{80}$ $b = 0.7363$	1 1 1 1 1 1	10
10	(a) $\int \frac{dy}{dx} dx = \int 2x dx$ $y = \frac{2x^2}{2} + c$ Pada / At (3, 12), $12 = \frac{2(3)^2}{2} + c$ $c = 3$ $\therefore y = x^2 + 3$	1 1 1	
	(b) Luas trapezium = $\frac{1}{2}(3)(3 + 12)$ Area of trapezium Luas di bawah graf = $\int_0^3 x^2 + 3 dx$ Area under the graph $\frac{1}{2}(3)(3 + 12) - \int_0^3 x^2 + 3 dx$ $= \frac{45}{2} - \left[\frac{x^3}{3} + 3x \right]_0^3$ $= \frac{45}{2} - \left[\left(\frac{3^3}{3} + 3(3) \right) - \left(\frac{0^3}{3} + 3(0) \right) \right]$ $= \frac{9}{2}$	1 1 1 1	
	(c) $\pi \int_3^t y - 3 dy = \pi \left[\frac{y^2}{2} - 3y \right]_3^t$ $= \pi \left[\left(\frac{t^2}{2} - 3t \right) - \left(\frac{3^2}{2} - 3(3) \right) \right]$ $= \pi \left(\frac{t^2}{2} - 3t + \frac{9}{2} \right)$	1 1 1	10

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
11	(a) $3 \sin x + 2 = \cos 2x$ $3 \sin x + 2 = 1 - 2 \sin^2 x$ $2 \sin^2 x + 3 \sin x + 1 = 0$ $(2 \sin x + 1)(\sin x + 1) = 0$ $\sin x = -\frac{1}{2}, \sin x = -1$ Sudut asas / Basic angle = $30^\circ, 90^\circ$ $x = (270^\circ - 30^\circ), 270^\circ, (360^\circ - 30^\circ)$ $\therefore x = 240^\circ, 270^\circ, 330^\circ$	1 1 1 1	10
	(b)  – Bentuk / Shape of $\sin x$ – $ \sin x $ – Translasi / Translation $\begin{pmatrix} 0 \\ 2 \end{pmatrix}$ – Nilai maksimum / Maximum value = 5	1 1 1 1	
	(c) $t < 2, t > 5$	2	

Bahagian C

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
12	(a) $\angle ADC = 115^\circ$ $AC^2 = 7^2 + 10^2 - 2(7)(10) \cos 115^\circ$ $AC^2 = 208.1666$ $AC = 14.4280$	1 1 1	10
	(b) $\frac{\sin \angle ACB}{12.32} = \frac{\sin 75^\circ}{14.4280}$ $\sin \angle ACB = 0.8248$ $\angle ACB = 55.5681^\circ$ $\angle CAB = 180^\circ - 75^\circ - 55.5681^\circ$ $= 49.4319^\circ$	1 1 1 1	
	(c) $\frac{1}{2}(12.32)(14.4280) \sin 49.4319^\circ$ dan / and $\frac{1}{2}(7)(10) \sin 115^\circ$ $\frac{1}{2}(12.32)(14.4280) \sin 49.4319^\circ + \frac{1}{2}(7)(10) \sin 115^\circ$ $= 67.51^\circ + 31.72^\circ$ $= 99.23^\circ$	1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks																
13	(a) (i) $\frac{6.30}{P_{2013}} \times 100 = 120$ $P_{2013} = \text{RM}5.25$	1 1																	
	(ii) $\frac{P_{2016}}{3.50} \times 100 = 140$ $P_{2016} = \text{RM}4.90$	1																	
	(b) $\frac{120(2) + 110(3) + 3x + 140(2)}{10} = 122.2$ $\frac{850 + 3x}{10} = 122.2$ $x = 124$	2 1																	
	(c) $I_{\frac{2018}{2016}} = \frac{120(2) + 100(3) + 95(3) + 100(2)}{10}$ $= 102.5$ <table border="1"><tr><td>$P_0 \backslash P_1$</td><td>2013</td><td>2016</td><td>2018</td></tr><tr><td>2013</td><td></td><td>122.2</td><td>x</td></tr><tr><td>2016</td><td></td><td>100</td><td>102.5</td></tr><tr><td>2018</td><td></td><td></td><td></td></tr></table> $\frac{122.3}{100} = \frac{x}{102.5}$ $x = 125.87$	$P_0 \backslash P_1$		2013	2016	2018	2013		122.2	x	2016		100	102.5	2018				1 1
	$P_0 \backslash P_1$	2013		2016	2018														
	2013			122.2	x														
2016		100	102.5																
2018																			
(d) $\frac{P_{2018}}{20} \times 100 = 125.87$ $P_{2018} = \text{RM}25.17$	1 1																		
14	(a) $45x + 60y \geq 540$ $x < 2y$ $y \leq 8$	1 1 1																	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
15	(a) $v = \int kt - 10 \, dt$ $v = \frac{kt^2}{2} - 10t + c$ Pada / At $t = 0, v = -8$ $-8 = \frac{k(0)^2}{2} - 10(0) + c$ $c = -8$ $v = \frac{kt^2}{2} - 10t - 8$ Pada / At $t = 5, v = 17$ $17 = \frac{k(5)^2}{2} - 10(5) - 8$ $k = 6$	1	10
	(b) $0 = 6t - 10$ $t = \frac{5}{3}$ $v = 3\left(\frac{5}{3}\right)^2 - 10\left(\frac{5}{3}\right) - 8$ $= -\frac{49}{3}$	1 1 1	
	(c) $2 = 6t - 10$ dan / and $0 = 3t^2 - 10t - 8$ $t = 2$ $0 = (3t + 2)(t - 4)$ $t = 4$	1	
	$\int_2^4 3t^2 - 10t - 8 \, dt$	1	
	$= \left \frac{3t^3}{3} - \frac{10t^2}{2} - 8t \right _2^4$		
	$= \left \left(\frac{3(4)^3}{3} - \frac{10(4)^2}{2} - 8(4) \right) - \left(\frac{3(2)^3}{3} - \frac{10(2)^2}{2} - 8(2) \right) \right $	1	
	$= -20 $		
	$= 20$	1	

KERTAS MODEL SIJIL PELAJARAN MALAYSIA 2026 (SET 5)

KERTAS 1

Bahagian A

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
1	$(a) \quad \begin{aligned} p(0) &= -4 \\ m(0) - k &= -4 \\ -k &= -4 \\ k &= 4 \end{aligned}$	1	4
	$\begin{aligned} p(-2) &= -8 \\ m(-2) - k &= -8 \\ -2m - 4 &= -8 \\ -2m &= -4 \\ m &= 2 \end{aligned}$	1	
	$(b) \text{ Katakan / Let } 2x - 4 = y$ $x = \frac{y + 4}{2}$ $\begin{aligned} p(x) &= y \\ p^{-1}(y) &= x \\ p^{-1}(y) &= \frac{y + 4}{2} \end{aligned}$	1	
	$\therefore p^{-1}(x) = \frac{x + 4}{2} \text{ atau / or } p^{-1}(x) = \frac{1}{2}x + 2$	1	
2	$(a) \quad \begin{aligned} x^2 &= ky \\ \log_{10} x^2 &= \log_{10} ky \\ 2 \log_{10} x &= \log_{10} k + \log_{10} y \\ \log_{10} y &= 2 \log_{10} x - \log_{10} k \end{aligned}$	1	5
		1	
	$(b) \quad \frac{4 - (-2)}{p - 0} = 2$ $\begin{aligned} 4 + 2 &= 2p \\ 6 &= 2p \\ 3 &= p \end{aligned}$	1	
	$\begin{aligned} -\log_{10} k &= -2 \\ \log_{10} k &= 2 \\ k &= 10^2 \\ k &= 100 \end{aligned}$	1	
3	$(a) \quad \frac{A}{1} \times \left(\frac{{}^6P_4}{1} \right) \times \frac{{}^4P_1}{1}$ ${}^2P_1 \times {}^6P_4 \times {}^4P_1 = 2\,880$	2	4
	$(b) \quad \begin{aligned} \frac{2}{3} \times \left(\frac{{}^7P_5}{3} \right) \\ \frac{3}{4} \times \left(\frac{{}^7P_5}{3} \right) \\ \frac{4}{4} \times \left(\frac{{}^7P_5}{3} \right) \end{aligned}$ ${}^3P_1 \times {}^7P_5 = 7\,560$	2	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
4	(a) $m + 0.25 + 2m + 2m + 0.30 = 1$ $5m + 0.55 = 1$ $5m = 0.45$ $m = 0.09$	1	6
		1	
	(b) ${}^4C_4 p^4 q^0 = 0.3$ $(1)(p^4)(1) = 0.3$ $p^4 = 0.3$ $p = \sqrt[4]{0.3}$ $p = 0.7401$	1	
	Min / Mean = $(4)(0.7401)$ $= 2.9604$	1	
		1	
5	$\cos 2\theta = \sin \theta$ $\cos^2 \theta - \sin^2 \theta = \sin \theta$ $(1 - \sin^2 \theta) - \sin^2 \theta - \sin \theta = 0$ $-2 \sin^2 \theta - \sin \theta + 1 = 0$ $2 \sin^2 \theta + \sin \theta - 1 = 0$ $(2 \sin \theta - 1)(\sin \theta + 1) = 0$	1	5
		1	
		1	
		1	
	$2 \sin \theta - 1 = 0$, $\sin \theta + 1 = 0$ $\sin \theta = -\frac{1}{2}$ (I dan / and II) $\sin \theta = -1$ (III dan / and IV) Sudut asas / Basic angle: 30° Sudut asas / Basic angle: 90° $\therefore \theta = 30^\circ, 150^\circ, 270^\circ$	1	
6	(a) $\frac{dx}{dy} = (2x - 1)^2; A(-1, 3)$ $= [2(-1) - 1]^2$ $= (-3)^2$ $= 9$	1	
	$m_1 m_2 = -1$ $9 \times m_2 = -1$ $m_2 = -\frac{1}{9}$		
	Persamaan normal di $A(-1, 3)$ / Equation of normal at $A(-1, 3)$: $y - y_1 = m(x - x_1)$ $y - 3 = -\frac{1}{9} [x - (-1)]$	1	
	$y - 3 = -\frac{1}{9} (x + 1)$ $y = -\frac{1}{9} x - \frac{1}{9} + 3$		
	$y = -\frac{1}{9} x + \frac{26}{9}$ atau / or $9y + x = 26$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(b) $\int dy = \int (2x - 1)^2 dx$ $y = \frac{(2x - 1)^3}{(3)(2)} + c$ $y = \frac{(2x - 1)^3}{6} + c; A(-1, 3)$ $3 = \frac{[2(-1) - 1]^3}{6} + c$ $3 = -\frac{9}{2} + c$ $\frac{15}{2} = c$ $\therefore y = \frac{(2x - 1)^3}{6} + \frac{15}{2} \text{ atau / or } 6y = (2x - 1)^3 + 45$	1 1 1	6
7	$2^{x+1} \cdot 5^{x+2} = 10^{2x-1}$ $(2^x)(2^1)(5^x)(5^2) = \frac{10^{2x}}{10^1}$ $(10^x)(50) = \frac{10^{2x}}{10}$ $500 = \frac{10^{2x}}{10^x}$ $500 = 10^x$ $\log_{10} 500 = x$ $2.6990 = x$	1 1 1 1 1 1	4
8	(a) $Q(x, y) = \left(\frac{(3)(-1) + (1)(8)}{1 + 3}, \frac{(3)(4) + (1)(2)}{1 + 3} \right)$ $= \left(\frac{5}{4}, \frac{7}{2} \right)$	1 1	
	(b) $m_{AB} = \frac{4 - 2}{-1 - 8}$ $= -\frac{2}{9}$ $m_1 m_2 = -1$ $-\frac{2}{9} m_2 = -1$ $m_2 = \frac{9}{2}$ Persamaan garis lurus / Equation of the straight line: $y - y_1 = m(x - x_1)$ $y - \frac{7}{2} = \frac{9}{2} \left(x - \frac{5}{4} \right)$ $y = \frac{9}{2}x - \frac{45}{8} + \frac{7}{2}$ $y = \frac{9}{2}x - \frac{17}{8} \text{ atau / or } 8y = 36x - 17$	1 1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(c) $AP = PB$ $\sqrt{[x - (-1)]^2 + (y - 4)^2} = \sqrt{(x - 8)^2 + (y - 2)^2}$ $(x + 1)^2 + (y - 4)^2 = (x - 8)^2 + (y - 2)^2$ $x^2 + 2x + 1 + y^2 - 8y + 16 = x^2 - 16x + 64 + y^2 - 4y + 4$ $18x - 4y - 51 = 0$	1 1 1	8
9	$2x^2 - 6x + 5 = 0$ Punca / Roots: α, β HTP / SOR: $\alpha + \beta = -\left(-\frac{6}{2}\right)$ $\alpha + \beta = 3$ HDP / POR: $\alpha\beta = \frac{5}{2}$ Punca baru / New roots: α^2, β^2 HTP baru / New SOR: $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$ $= (3)^2 - 2\left(\frac{5}{2}\right)$ $= 4$ HDP baru / New POR: $\alpha^2\beta^2 = (\alpha\beta)^2$ $= \left(\frac{5}{2}\right)^2$ $= \frac{25}{4}$ Persamaan baru / New equation: $x^2 - (\text{HTP})x + \text{HDP} = 0$ $x^2 - 4x + \frac{25}{4} = 0 \text{ atau / or } 4x^2 - 16x + 25 = 0$	1 1 1 1 1	5
10	(a) $T_7 = a + (n - 1)d$ $= 6 + (7 - 1)(0.5)$ $= 9 \text{ cm}$	1 1	5
	(b) $T_n > 95$ $6 + (n - 1)(0.5) > 95$ $0.5n - 0.5 > 89$ $0.5n > 89.5$ $n > 179$	1 1	
	$\therefore n = 180 \text{ hari / days}$	1	
11	(a) $\vec{OA} = -i + 4j$ $\vec{OB} = 6i + 8j$ $\vec{OC} = mi + nj$ $\vec{AB} - 2\vec{BC} = 3i - 6j$ $(\vec{AO} + \vec{OB}) - 2(\vec{BO} + \vec{OC}) = 3i - 6j$ $(-\vec{OA} + \vec{OB}) - 2(-\vec{OB} + \vec{OC}) = 3i - 6j$ $(i - 4j + 6i + 8j) - 2(-6i - 8j + mi + nj) = 3i - 6j$ $7i + 4j + 12i + 16j - 2mi - 2nj = 3i - 6j$ $(19 - 2m)i + (20 - 2n)j = 3i - 6j$	1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	$i: 19 - 2m = 3$ $-2m = -16$ $m = 8$	1	6
	$j: 20 - 2n = -6$ $-2n = -26$ $n = 13$	1	
	(b) Luas / Area $= \frac{1}{2} \begin{vmatrix} -1 & 6 & 8 & -1 \\ 4 & 8 & 13 & 4 \end{vmatrix}$ $= \frac{1}{2} (-8 + 78 + 32) - (24 + 64 - 13) $ $= \frac{1}{2} 102 - 75 $ $= \frac{1}{2} (27)$ $= 13 \frac{1}{2} \text{ unit}^2$	1	
		1	
12	(a) $\int_4^1 f(x) \, dx = -\int_1^4 f(x) \, dx$ $= -10$	1	6
	(b) $2\int_4^1 g(x) \, dx - 3\int_1^4 f(x) \, dx = 2(-5) - 3(10)$ $= -10 - 30$ $= -40$	1 1	
	(c) $\int_1^4 [k - g(x)] \, dx = \int_0^2 4x \, dx$ $\int_1^4 k \, dx - \int_1^4 g(x) \, dx = \left[\frac{4x^2}{2} \right]_0^2$ $[kx]_1^4 - 5 = [2x^2]_0^2$ $[k(4) - k(1)] - 5 = [2(2)^2] - [2(0)^2]$ $4k - k - 5 = 8$ $3k = 13$ $k = \frac{13}{3}$	2 1	

Bahagian B

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
13	(a) $3x^2 - 2x - 5 = 0$ $(3x - 5)(x + 1) = 0$ $3x - 5 = 0$, $x + 1 = 0$ $x = \frac{5}{3}$ $x = -1$	2	
	$\therefore A\left(\frac{5}{3}, 0\right)$ dan / and $B(-1, 0)$	2	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(b) (i) $f(x) = 3x^2 - 2x - 5$ $= 3\left(x^2 - \frac{2}{3}x - \frac{5}{3}\right)$ $= 3\left[x^2 - \frac{2}{3}x + \left(\frac{-\frac{2}{3}}{2}\right)^2 - \left(\frac{-\frac{2}{3}}{2}\right)^2 - \frac{5}{3}\right]$ $= 3\left[x^2 - \frac{2}{3}x + \left(-\frac{1}{3}\right)^2 - \left(-\frac{1}{3}\right)^2 - \frac{5}{3}\right]$ $= 3\left[\left(x - \frac{1}{3}\right)^2 - \frac{1}{9} - \frac{5}{3}\right]$ $= 3\left[\left(x - \frac{1}{3}\right)^2 - \frac{16}{9}\right]$ $= 3\left(x - \frac{1}{3}\right)^2 - \frac{16}{3}$ (ii) $a = 3 > 0$ $\therefore f(x)$ mempunyai titik pusingan minimum pada titik $\left(\frac{1}{3}, -\frac{16}{3}\right)$ $f(x)$ has a minimum turning point at $\left(\frac{1}{3}, -\frac{16}{3}\right)$.	1 1 2	8
14	(a) $\theta = \frac{(360^\circ - 240^\circ)}{180^\circ} \times \pi$ $= 2.095 \text{ rad}$ (b) $s = r\theta$ $20 = r(2.095)$ $\frac{20}{2.095} = r$ $9.5465 \text{ cm} = r$ (c) Luas sektor DOC / Area of sector $DOC = \frac{1}{2} r^2 \theta$ $= \frac{1}{2} (9.4565 + 3)^2 (2.095)$ $= 162.5347 \text{ cm}^2$ Luas segi tiga BOA / Area of triangle $BOA = \frac{1}{2} ab \sin C$ $= \frac{1}{2} (9.4565)(9.4565) \sin 120^\circ$ $= 38.7223 \text{ cm}^2$ Luas kawasan berlorek / Area of the shaded region $= 162.5347 \text{ cm}^2 - 38.7223 \text{ cm}^2$ $= 123.8124 \text{ cm}^2$	1 1 1 1 1 1 1	8

Bahagian A

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
1	$2x + 3y - z = 3 \dots \textcircled{1}$ $x + y + z = -1 \dots \textcircled{2}$ $-x - 2y + 3z = 4 \dots \textcircled{3}$ $\textcircled{2} + \textcircled{3}: (x + y + z) + (-x - 2y + 3z) = -1 + 4$ $x + y + z - x - 2y + 3z = 3$ $-y + 4z = 3$ $4z - 3 = y \dots \textcircled{4}$ $\textcircled{1} - 2 \times \textcircled{2}: (2x + 3y - z) - 2(x + y + z) = 3 - 2(-1)$ $2x + 3y - z - 2x - 2y - 2z = 3 + 2$ $y - 3z = 5$ $y = 5 + 3z \dots \textcircled{5}$ $\textcircled{4} = \textcircled{5}: 4z - 3 = 5 + 3z$ $4z - 3z = 5 + 3$ $z = 8$ Daripada / From $\textcircled{5}: y = 5 + 3z$ $= 5 + 3(8)$ $= 29$ Daripada / From $\textcircled{2}: x + y + z = -1$ $x + 29 + 8 = -1$ $x = -1 - 29 - 8$ $x = -38$	1 1 1 1 1	5
2	(a) $h(0) = p(0) + 10 - (0)^2$ $= 10$ $R(0, 10)$ (b)	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	$\frac{x+5}{2} = \frac{3}{2}$ $2x + 10 = 6$ $2x = -4$ $x = -2$	1	9
	$\therefore h(x) < 0$ apabila $x < -2$ atau $x > 5$ $h(x) < 0$ when $x < -2$ or $x > 5$	1	
	$(c) h(x) = -x^2 + px + 10$ $= -(x^2 - px - 10)$ $= -\left[x^2 - px + \left(-\frac{p}{2}\right)^2 - \left(-\frac{p}{2}\right)^2 - 10\right]$ $= -\left[\left(x - \frac{p}{2}\right)^2 - \frac{p^2}{4} - 10\right]$ $= -\left(x - \frac{p}{2}\right)^2 + \frac{p^2}{4} + 10$	1	
	$x - \frac{p}{2} = 0$ $x = \frac{p}{2}$	1	
	$\frac{3}{2} = \frac{p}{2}$ $p = 3$	1	
	$(d) \frac{p^2}{4} + 10 = \frac{(3)^2}{4} + 10$ $= 12\frac{1}{4}$ $\therefore Q\left(1\frac{1}{2}, 12\frac{1}{4}\right)$	1	
3	$(a) \frac{\sqrt{5}}{\sqrt{3}+2} = \frac{\sqrt{5}}{\sqrt{3}+2} \times \frac{-\sqrt{3}+2}{-\sqrt{3}+2}$ $= \frac{-\sqrt{15}+2\sqrt{5}}{-3+4}$ $= -\sqrt{15}+2\sqrt{5}$	1 1 1	6
	$(b) 3^{x+2} - 3^x + 45(3^{x-2}) = (3^x)(3^2) - 3^x + 45(3^x)\left(\frac{1}{3^2}\right)$ $= (3^x)\left[3^2 - 1 + 45\left(\frac{1}{3^2}\right)\right]$ $= (3^x)(9 - 1 + 5)$ $= 13(3^x)$	1 1 1	
	$3^{x+2} - 3^x + 45(3^{x-2})$ boleh ditulis dalam bentuk $13(3^x)$, maka ianya boleh dibahagikan dengan 13. Ditunjukkan.		
	$3^{x+2} - 3^x + 45(3^{x-2})$ can be written in the form $13(3^x)$, thus it is divisible by 13. Shown.		

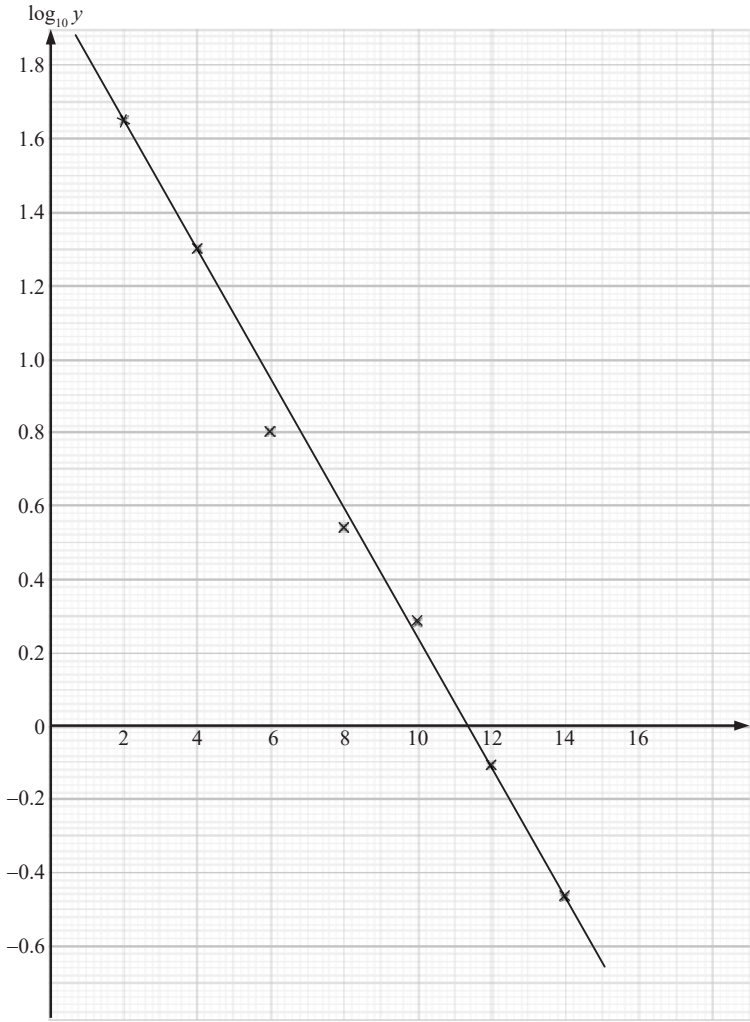
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
4	(a) (i) $\vec{AC} = \vec{AB} + \vec{BC}$ $\vec{AC} = 10\vec{a} - 6\vec{b}$ (ii) $\vec{FA} = \vec{FC} + \vec{CA}$ $\vec{FA} = \frac{1}{3}\vec{BC} + \vec{CA}$ $\vec{FA} = \frac{1}{3}(-6\vec{b}) + (-10\vec{a} + 6\vec{b})$ $\vec{FA} = -2\vec{b} - 10\vec{a} + 6\vec{b}$ $\vec{FA} = -10\vec{a} + 4\vec{b}$	1 1 1 1	
	(b) $\vec{AE} = \vec{AB} + \vec{BE}$ $= 10\vec{a} + m\vec{BD}$ $= 10\vec{a} + m(\vec{BA} + \vec{AD})$ $= 10\vec{a} + m\left(-10\vec{a} + \frac{1}{2}\vec{AC}\right)$ $= 10\vec{a} + m\left[-10\vec{a} + \frac{1}{2}(10\vec{a} - 6\vec{b})\right]$ $= 10\vec{a} + m(-10\vec{a} + 5\vec{a} - 3\vec{b})$ $= 10\vec{a} + m(-5\vec{a} - 3\vec{b})$ $= (10 - 5m)\vec{a} - 3m\vec{b}$	 1 1	
	(c) $\vec{AE} = \lambda \vec{AF}$ $(10 - 5m)\vec{a} - 3m\vec{b} = \lambda(10\vec{a} - 4\vec{b})$ Bandingkan kedua-dua belah / Compare both sides: $\vec{a}$: $10 - 5m = 10\lambda \dots \textcircled{1}$ $\vec{b}$: $-3m = -4\lambda$ $\frac{3m}{4} = \lambda \dots \textcircled{2}$ Ganti / Substitute $\textcircled{2}$ ke dalam / into $\textcircled{1}$: $10 - 5m = 10\left(\frac{3m}{4}\right)$ $10 = \frac{15m}{2} + 5m$ $10 = \frac{25m}{2}$ $\frac{4}{5} = m$	1 1 1	9

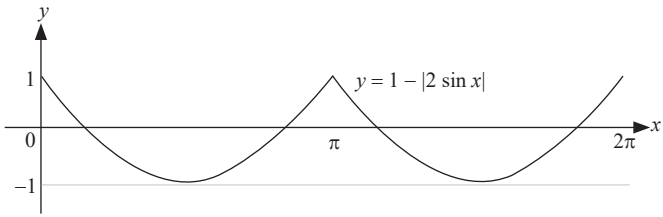
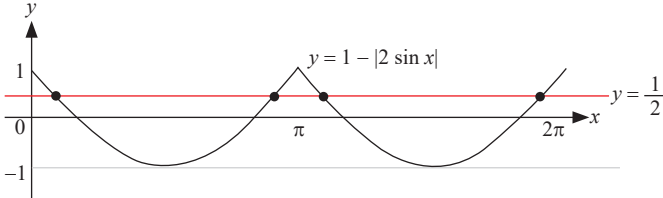
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No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(b) Janjang geometri / <i>Geometric progression: a, ar, ar², ar³, ...</i> $8S_3 = S_{4 \rightarrow 6}$ $8(a + ar + ar^2) = ar^3 + ar^4 + ar^5$ $8(a + ar + ar^2) = ar^3(1 + r + r^2)$ $\frac{8a(1 + r + r^2)}{a(1 + r + r^2)} = r^3$ $8 = r^3$ $\sqrt[3]{8} = r^3$ $r = 2$	1 1 1	6
7	(a) $\frac{1}{2} \left \begin{matrix} 1 & 8 & p & 1 \\ 2 & 3 & -1 & 3 \end{matrix} \right = 13$ $\frac{1}{2} [(1)(2) + (8)(-1) + (p)(3)] - [(3)(8) + (p)(2) + (1)(-1)] = 13$ $ (2 - 8 + 3p) - (24 + 2p - 1) = 26$ $ -29 + p = 26$ $-29 + p = 26, \quad -29 + p = -26$ $p = 55 \text{ (Abaikan / Ignore)} \quad p = 3$ $\therefore p = 3$	1 1 1 1	
	(b) Katakan $P(x, y)$ ialah koordinat bagi bola <i>Let $P(x, y)$ be the coordinates of the ball</i> $P(x, y) = \left(\frac{(2)(3) + (1)(8)}{1 + 2}, \frac{(2)(-1) + (1)(2)}{1 + 2} \right)$ $= \left(\frac{14}{3}, 0 \right)$	1 1	
	(c) Katakan $D(x, y)$ ialah koordinat pemain <i>Let $D(x, y)$ be the coordinates of the player</i> $DB = DP$ $\sqrt{(x - 3)^2 + [y - (-1)]^2} = \sqrt{\left(x - \frac{14}{3}\right)^2 + (y - 0)^2}$ $\sqrt{x^2 - 6x + 9 + y^2 + 2y + 1} = \sqrt{x^2 - \frac{28}{3}x + \frac{196}{9} + y^2}$ $\frac{10}{3}x + 2y = \frac{106}{9}$ $15x + 9y = 53$	1 1 1	8

Bahagian B

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
8	(a) (i) Min / Mean = 120 $(n)(0.3) = 120$ $n = 400$	1 1	
	(ii) $n = 15, p = 0.3, q = 0.7$ $P(X \geq 2) = 1 - P(X \leq 1)$ $= 1 - P(X = 0) - P(X = 1)$ $= 1 - {}^{15}C_0(0.3)^0(0.7)^{15-0} - {}^{15}C_1(0.3)^1(0.7)^{15-1}$ $= 1 - {}^{15}C_0(0.3)^0(0.7)^{15} - {}^{15}C_1(0.3)^1(0.7)^{14}$ $= 1 - 0.004748 - 0.03052$ $= 0.9647$	2 1	
	(b) (i) $X \sim N(55, 14^2)$ $P(X > 65) = P\left(Z > \frac{65 - 55}{14}\right)$ $= P(Z > 0.714)$ $= 0.2377$	1 1	
	(ii) $P(X \leq m) = 0.44$ $P\left(Z \leq \frac{m - 55}{14}\right) = 0.44$ $\frac{m - 55}{14} = -0.151$ $m - 55 = -2.114$ $m = 52.886 \text{ kg}$	1 1 1	
		1	
			10

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks																								
9	(a) <table border="1"><tr><td>x</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td><td>12</td><td>14</td></tr><tr><td>y</td><td>44.44</td><td>19.75</td><td>6.31</td><td>3.47</td><td>1.91</td><td>0.77</td><td>0.34</td></tr><tr><td>$\log_{10} y$</td><td>1.65</td><td>1.30</td><td>0.80</td><td>0.54</td><td>0.28</td><td>-0.11</td><td>-0.47</td></tr></table> 	x	2	4	6	8	10	12	14	y	44.44	19.75	6.31	3.47	1.91	0.77	0.34	$\log_{10} y$	1.65	1.30	0.80	0.54	0.28	-0.11	-0.47	1	
	x	2	4	6	8	10	12	14																			
	y	44.44	19.75	6.31	3.47	1.91	0.77	0.34																			
$\log_{10} y$	1.65	1.30	0.80	0.54	0.28	-0.11	-0.47																				
(b) Salah catat di / <i>Wrongly recorded at</i> (6, 0.8) Koordinat betul / <i>Correct coordinates:</i> (6, 0.94) $\log_{10} y = 0.94$ $y = 10^{0.94}$ $y = 8.7096$	3																										
(c) (i) $y = \frac{p}{q^x}$ $y = pq^{-x}$ $\log_{10} y = \log_{10} p + \log_{10} q^{-x}$ $\log_{10} y = \log_{10} p - x \log_{10} q$ $\log_{10} y = (-\log_{10} q)x + \log_{10} p$ $Y = mX + C$	1																										

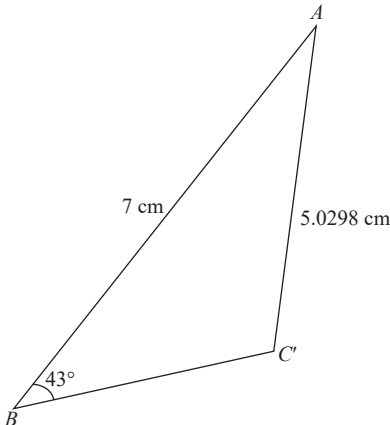
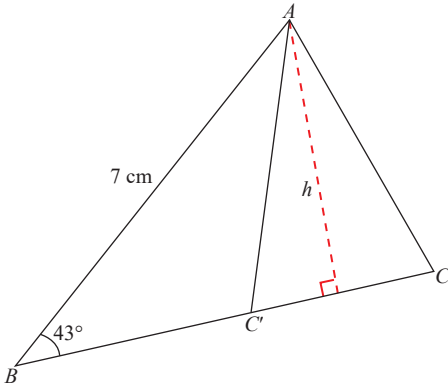
	(b) Salah catat di / <i>Wrongly recorded at</i> (6, 0.8) Koordinat betul / <i>Correct coordinates:</i> (6, 0.94) $\log_{10} y = 0.94$ $y = 10^{0.94}$ $y = 8.7096$	1	
	(c) (i) $y = \frac{p}{q^x}$ $y = pq^{-x}$ $\log_{10} y = \log_{10} p + \log_{10} q^{-x}$ $\log_{10} y = \log_{10} p - x \log_{10} q$ $\log_{10} y = (-\log_{10} q)x + \log_{10} p$ $Y = mX + C$ $\log_{10} p = 2.0$ $p = 10^{2.0}$ $p = 100$ (ii) $m = \frac{1.65 - 1.3}{2 - 4}$ $m = -0.175$ $-\log_{10} q = m$ $-\log_{10} q = -0.175$ $-\log_{10} q = m$ $q = 10^{0.175}$ $q = 1.4962$	1 1 1 1 1 1 1	10
10	(a) $\frac{1 + \cos 2x}{\sin 2x} = \frac{1 + \cos^2 x - \sin^2 x}{2 \sin x \cos x}$ $= \frac{\cos^2 x + \sin^2 x + \cos^2 x - \sin^2 x}{2 \sin x \cos x}$ $= \frac{2 \cos^2 x}{2 \sin x \cos x}$ $= \frac{\cos x}{\sin x}$ $= \cot x$ (Ditunjukkan / <i>Shown</i>) (b) (i)  (ii)  $2 \sin x + \frac{1}{2} = 1$ $\frac{1}{2} = 1 - 2 \sin x$ $\frac{1}{2} = y$ Bilangan penyelesaian / <i>Number of solutions:</i> 4	1 1 1 1 1 1 1 1	10

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
11	(a) $y = x^3 + x^2 - x + 5$ $\frac{dy}{dx} = 3x^2 + 2x - 1$ Fungsi kecerunan pada $S(-2, 3)$ / <i>Gradient function at $S(-2, 3)$</i> $\frac{dy}{dx} = 3(-2)^2 + 2(-2) - 1$ $= 7$	1 1 1	
	(b) Kecerunan garisan normal / <i>Gradient of the normal line</i> $m_1 m_2 = -1$ $7 \times m_2 = -1$ $m_2 = -\frac{1}{7}$ Persamaan normal pada $S(-2, 3)$ / <i>Equation of normal at $S(-2, 3)$</i> $y - y_2 = m(x - x_1)$ $y - 3 = -\frac{1}{7} [x - (-2)]$ $y = -\frac{1}{7}x - \frac{2}{7} + 3$ $y = -\frac{1}{7}x + \frac{19}{7}$ atau / <i>or $7y + x = 19$</i>	1 1 1	
	(c) $\frac{dy}{dx} = 0$ $3x^2 + 2x - 1 = 0$ $(3x - 1)(x + 1) = 0$ $x = \frac{1}{2}$ (Abaikan / <i>Ignore</i>) , $x = -1$ (Abaikan / <i>Ignore</i>) Apabila / <i>When $x = \frac{1}{3}$</i>; $y = \left(\frac{1}{3}\right)^3 + \left(\frac{1}{3}\right)^2 - \left(\frac{1}{3}\right) + 5$ $= 44\frac{22}{27}$ $\therefore B\left(\frac{1}{3}, 44\frac{22}{27}\right)$ $\frac{d^2y}{dx^2} = 6x + 2$ $= 6\left(\frac{1}{3}\right) + 2$ $= 4 > 0$ $\therefore B\left(\frac{1}{3}, 44\frac{22}{27}\right)$ ialah titik minimum / <i>is a minimum point.</i>	1 1 1 1	
			10

Bahagian C

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
12	(a) Halaju maksimum / <i>Maximum velocity</i>: $a_p = 0$ $\frac{dv_p}{dt} = 0$ $2t - 1 = 0$ $t = \frac{1}{2}$ Apabila / <i>When</i> $t = \frac{1}{2}$; $v_p = \left(\frac{1}{2}\right)^2 - \left(\frac{1}{2}\right) - 6$ $= -6\frac{1}{4} \text{ m s}^{-1}$	1 1 1	
	(b) Halaju maksimum / <i>Maximum velocity</i>: $v_p = 0$ $t^2 - t - 6 = 0$ $(t + 2)(t - 3) = 0$ $t + 2 = 0, \quad t - 3 = 0$ $t = -2 \text{ (Abaikan / Ignore)} \quad t = 3$ $s_p = \int (t^2 - t - 6) dt$ $= \frac{t^3}{3} - \frac{t^2}{2} - 6t + c$ Apabila / <i>When</i> $t = 0, s_p = 0$; $s_p = \frac{t^3}{3} - \frac{t^2}{2} - 6t + c$ $0 = \frac{(0)^3}{3} - \frac{(0)^2}{2} - 6(0) + c$ $0 = c$ $\therefore s_p = \frac{t^3}{3} - \frac{t^2}{2} - 6t$ Apabila / <i>When</i> $t = 3$; $s_p = \frac{(3)^3}{3} - \frac{(3)^2}{2} - 6(3)$ $s_p = -13\frac{1}{2} \text{ m}$	1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
	(c) $s_Q = \int v_Q dt$ $= \int (-7) dt$ $= -7t + c$ Apabila / When $t = 0$, $s_Q = 0$; $s_Q = -7t + c$ $0 = -7(0) + c$ $0 = c$ $\therefore s_Q = -7t$ Apabila / When $t = 3$; $s_Q = -7(3)$ $s_Q = -21$ m (Q berada 21 m dari titik B / Q is 21 m from point B) Kedudukan Q dari A / Position of Q from A: $25 \text{ m} - 21 \text{ m} = 4 \text{ m}$ $\therefore$ Bola Q berada 4 m di sebelah kanan titik A. Ball Q is 4 m to the right of point A.	1 1 1 1	10
13	(a) $P: I_{22/19} = 150$ $\frac{x}{9.10} \times 100 = 150$ $x = 13.65$ $Q: I_{22/19} = \frac{2.50}{1.50} \times 100$ $y = 166.67$ $R: I_{22/19} = 165$ $\frac{21}{z} \times 100 = 165$ $z = 12.73$	1 1 1	
	(b) $I_{22/19} = \frac{(55)(150) + (166.67)(30) + (15)(165)}{55 + 15 + 30}$ $= 157.25$	2 1	
	(c) $I_{23/22} = 130$ $I_{23/19} = \frac{157.25 \times 130}{100}$ $= 204.43$ $\frac{P_{2023}}{P_{2019}} \times 100 = 204.43$ $\frac{45 - 12}{P_{2019}} \times 100 = 204.43$ $P_{2019} = \text{RM}16.14$	1 1 1 1	10

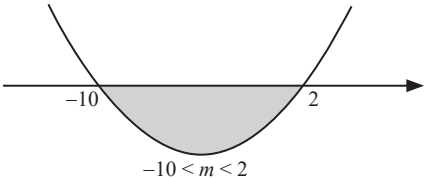
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Markah Total Total Marks
14	(a) (i) $\frac{1}{2} (7)(BC) \sin 43^\circ = 16 \text{ unit}^2$ $BC = 6.703$ (ii) $AC^2 = 7^2 + (6.703)^2 - 2(7)(6.703) \cos 43^\circ$ $AC^2 = 25.2985$ $AC = \sqrt{25.2985}$ $AC = 5.0298 \text{ cm}$ (iii) $\frac{\sin \angle ACB}{7} = \frac{\sin 43^\circ}{5.0298}$ $\sin \angle ACB = 0.9491$ $\angle ACB = \sin^{-1} 0.9491$ $= 71.64^\circ$	1 1 1 1 1	10
	(b) (i)  (ii) $\angle AC'B = 180^\circ - 71.64^\circ$ $= 108.36^\circ$ (iii)  $\sin 43^\circ = \frac{h}{7}$ $h = 7 \sin 43^\circ$ $h = 4.774 \text{ cm}$	1 1 1 1	
15	(a) I $85x + 60y \leq 6\,500$ II $x + y \geq 55$ III $y \geq x$	1 1 1	

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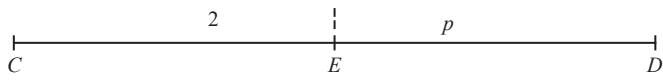
KERTAS 1

Bahagian A

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
1	$64(4^{2x+1}) = 1$ $2^6(2^{4x+2}) = 2^0$ $2^{4x+8} = 2^0$ $4x + 8 = 0$ $4x = -8$ $x = -2$	 1 1 1	3
2	$(\sqrt{48} \times \sqrt{20}) - (\sqrt{5} \times \sqrt{3}) = \sqrt{m}$ $(\sqrt{16 \times 3} \times \sqrt{4 \times 5}) - \sqrt{5 \times 3} = \sqrt{m}$ $(4\sqrt{3} \times 2\sqrt{5}) - \sqrt{15} = \sqrt{m}$ $8\sqrt{15} - \sqrt{15} = \sqrt{m}$ $7\sqrt{15} = \sqrt{m}$ $\sqrt{735} = \sqrt{m}$ $m = 735$	 1 1 1	3
3	(a) $f(x) = 2x^2 + 5x - 1$ $f(h) = -3$ $2h^2 + 5h - 1 = -3$ $2h^2 + 5h + 2 = 0$ $(2h + 1)(h + 2) = 0$ $2h + 1 = 0$; $h + 2 = 0$ $h = -\frac{1}{2}$ $h = -2$ $\therefore h = -\frac{1}{2}$ (b) Katakan / Let $3x - 4 = y$ $x = \frac{y + 4}{3}$ $\therefore m^{-1}(x) = \frac{x + 4}{3}$ $6m^{-1}(k) = 12$ $6\left(\frac{k + 4}{3}\right) = 12$ $\frac{k + 4}{3} = 2$ $k + 4 = 6$ $k = 2$	 1 1 1 1 1 1 1	6

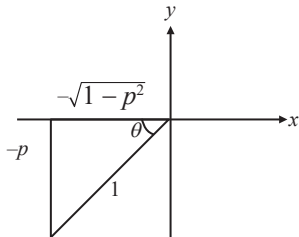
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
4	(a) $x - 1 = 0$ $x = 1$ Maka/So, $p = 1$ $k - 4 = 4$ $k = 8$ $f(0) = c$ $-(0 - 1)^2 + 8 - 4 = c$ $c = 3$ (b) $f(x) = x^2 + (2 + m)x - m + 6$ $a = 1, b = 2 + m, c = -m + 6$ Tiada pintasan-x / No x-intercept: $b^2 - 4ac < 0$ $(2 + m)^2 - 4(1)(-m + 6) < 0$ $4 + m^2 + 4m + 4m - 24 < 0$ $m^2 + 8m - 20 < 0$ $(m - 2)(m + 10) < 0$  $-10 < m < 2$	1 1 1 1 1 1	6
5	(a) $d_1 = 3(p + 2) - 3(p)$ $d_2 = 3(p + 4) - 3(p + 2)$ $= 3p + 6 - 3p$ $= 3p + 12 - 3p - 6$ $= 6$ $= 6$ $\therefore d_1 = d_2 = 6$ $\therefore$ Janjang aritmetik / Arithmetic progression (Ditunjukkan / Shown) (b) $S_{12} = \frac{12}{2}[2(3p) + (12 - 1)(6)]$ $\frac{n}{2} [2a + (n - 1)d]$ $S_{12} = 6(6p + 66)$ $S_{12} = 36p + 396$	1 1 1 1 1	5
6	$(ky)^2 = py + kx$ $k^2 y^2 = py + kx$ $y = \frac{py}{k^2 y} + \frac{kx}{k^2 y}$ $y = \frac{p}{k^2} + \frac{x}{ky}$ $y = \frac{1}{k} \left(\frac{x}{y} \right) + \frac{p}{k^2}$ $Y = mX + C$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	$\frac{1}{k} = \frac{3-1}{12-8}$ $\frac{1}{k} = \frac{1}{2}$ $k = 2$ $y = \frac{1}{k}\left(\frac{x}{y}\right) + \frac{p}{k^2}$ $1 = \frac{1}{2}(8) + \frac{p}{(2)^2}$ $-3 = \frac{p}{4}$ $p = -12$	1 1	4
7	(a) $L = \frac{1}{2}j^2\theta$ $57 \text{ cm}^2 = \frac{1}{2}(12)^2\theta$ $\theta = 0.7917 \text{ radian}$ (b) $\theta = 2(3.142) - 3(0.7917)$ $\theta = 3.9089 \text{ rad}$ $s = r\theta$ $= (12)(3.9089)$ $= 46.91 \text{ cm}$ Perimeter = 12 cm + 12 cm + 46.91 cm = 70.91 cm	1 1 1 1 1 1	5
8	(a) ${}^{12}C_6 = 924$ (b) ${}^3C_2 \times {}^4C_3 \times {}^5C_1 = 3 \times 4 \times 5$ = 60 (c) 2 orang pengawas, 2 orang pengerusi kelab, 2 orang ketua kelas 2 prefects, 2 club presidents, 2 class leaders ${}^5C_2 \times {}^4C_2 \times {}^3C_2$ 2 orang pengawas, 3 orang pengerusi kelab, 1 orang ketua kelas 2 prefects, 3 club presidents, 1 class leaders ${}^5C_2 \times {}^4C_3 \times {}^3C_1$ 2 orang pengawas, 4 orang pengerusi kelab 2 prefects, 4 club presidents ${}^5C_2 \times {}^4C_4 \times {}^3C_0$ $({}^5C_2 \times {}^4C_2 \times {}^3C_2) + ({}^5C_2 \times {}^4C_3 \times {}^3C_1) + ({}^5C_2 \times {}^4C_4 \times {}^3C_0)$ = $(10 \times 6 \times 3) + (10 \times 4 \times 3) + (10 \times 1 \times 1)$ = 180 + 120 + 10 = 310	1 1 1 1 1	6
9	(a) Jumlah luas permukaan kubus / Total surface area of cube: $A = 6x^2$ $\frac{dA}{dx} = 12x$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	Isi padu kubus / <i>Volume of cube</i>: $x^3 = 343$ $x = \sqrt[3]{343}$ $= 7 \text{ cm}$ $\frac{dx}{dt} = \frac{dx}{dA} \times \frac{dA}{dt}$ $\frac{dx}{dt} = \frac{1}{12x} \times 10$ $= \frac{5}{6x}$ $= \frac{5}{6(7)}; \text{ apabila / when } x = 7$ $= \frac{5}{42} \text{ cm s}^{-1}$ (b) $y = mx^2 + kx - 5$; pada / at $(-1, 6)$ $6 = m(-1)^2 + k(-1) - 5$ $6 = m - k - 5$ $6 + 5 + k = m$ $11 + k = m \text{ ①}$ Di titik pegun / <i>At stationary point</i> : $\frac{dy}{dx} = 0$ $2mx + k = 0$ $2m(-1) + k = 0; \text{ apabila / when } x = -1$ $-2m + k = 0 \text{ ②}$ Gantikan ① ke dalam ② / <i>Substitute ① into ②</i> : $-2(11 + k) + k = 0$ $-22 - 2k + k = 0$ $-22 - k = 0$ $k = -22$ Dari / <i>From ①</i>; $m = 11 + (-22)$ $m = 11 - 22$ $m = -11$	1 1 1 1 1 1 1 1 1	8
10	(a) (i) $\overrightarrow{DC} = \overrightarrow{DA} + \overrightarrow{AB} + \overrightarrow{BC}$ $= -3\tilde{x} + 3\tilde{y} + 6\tilde{x}$ $= 3\tilde{x} + 3\tilde{y}$ (ii)  $\overrightarrow{BE} = \overrightarrow{BC} + \overrightarrow{CE}$ $= 6\tilde{x} + \frac{2}{2+p} \overrightarrow{CD}$ $= 6\tilde{x} + \frac{2}{2+p} (-3\tilde{x} - 3\tilde{y})$ $= \left(6 - \frac{6}{2+p}\right)\tilde{x} - \frac{6}{2+p}\tilde{y}$	1 1 1 1	

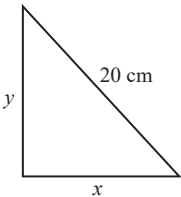
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	$(b) \int_{-1}^2 f(x) dx = \int_{-1}^2 \frac{d}{dx} \left(\frac{x^2}{2x-1} \right) dx$ $= \left[\frac{x^2}{2x-1} \right]_{-1}^2$ $= \left[\frac{(2)^2}{2(2)-1} \right] - \left[\frac{(-1)^2}{2(-1)-1} \right]$ $= \frac{4}{3} - \left(-\frac{1}{3} \right)$ $= \frac{5}{3}$	 1 1 1	6

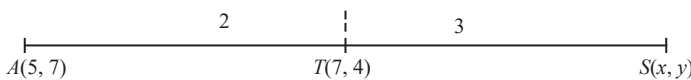
Bahagian B

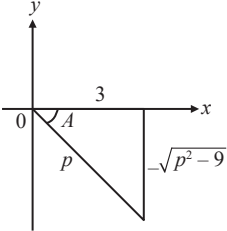
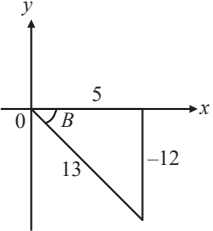
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
13	$(a) \quad g(x) = \frac{2}{3}$ $\frac{2}{6x-1} = \frac{2}{3}$ $12x - 2 = 6$ $x = \frac{2}{3}$ $(b) \quad (i) \quad f^2(x) = 5px + 10$ $f(5x + 2h) = 5px + 10$ $5(5x + 2h) + 2h = 5px + 10$ $25x + 10h + 2h = 5px + 10$ $25x + 12h = 5px + 10$ $5px = 25x$ $p = \frac{25x}{5x}$ $p = 5$ $12h = 10$ $h = \frac{5}{6}$ $(ii) \quad f^2 g(x) = f^2 \left(\frac{2}{6x-1} \right)$ $= 25 \left(\frac{2}{6x-1} \right) + 10$ $= \frac{50}{6x-1} + 10; x \neq \frac{1}{6}$	 1 1 1 1 1 1 1 1	8
14	(a) 		

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks				
	(i) $\frac{1}{\sin 2\theta} = \frac{1}{2 \sin \theta \cos \theta}$ $= \frac{1}{2(-p)(-\sqrt{1-p^2})}$ $= \frac{1}{2p\sqrt{1-p^2}}$ (ii) $\cos \theta \cos 90^\circ - \sin \theta \sin 90^\circ = (-\sqrt{1-p^2})(0) - (-p)(1)$ $= p$ (b) $3 \sec^2 \theta = 5(1 - \tan \theta)$ $3(\tan^2 \theta + 1) = 5 - 5 \tan \theta$ $3\tan^2 \theta + 3 - 5 + 5 \tan \theta = 0$ $3\tan^2 \theta + 5 \tan \theta - 2 = 0$ $(3\tan \theta - 1)(\tan \theta + 2) = 0$<table><tr><td>$3\tan \theta - 1 = 0$</td><td>$\tan \theta + 2 = 0$</td></tr><tr><td>$\tan \theta = \frac{1}{3}$</td><td>$\tan \theta = -2$</td></tr></table> Sudut rujukan : 18.43° (I , III) Reference angle Sudut rujukan : 63.43° (II , IV) Reference angle $\theta = 18.43^\circ, 180^\circ - 63.43^\circ, 180^\circ + 18.43^\circ, 360^\circ - 63.43^\circ$ $\theta = 18.43^\circ, 116.57^\circ, 198.43^\circ, 296.57^\circ$	$3\tan \theta - 1 = 0$	$\tan \theta + 2 = 0$	$\tan \theta = \frac{1}{3}$	$\tan \theta = -2$	1 1 1 1 1 1 1	8
$3\tan \theta - 1 = 0$	$\tan \theta + 2 = 0$						
$\tan \theta = \frac{1}{3}$	$\tan \theta = -2$						
15	(a) (i) $\frac{3}{20} + m + 0.2 + 0.375 + \frac{3}{20} + m = 1$ $\frac{7}{8} + 2m = 1$ $m = \frac{1}{16}$ (ii) $P(X \geq 3) = P(X = 3) + P(X = 4) + P(X = 5)$ $= 0.375 + \frac{3}{20} + \frac{1}{16}$ $= \frac{47}{80}$ (b) (i) $P(k < Z < 0.75) = 0.6546$ $1 - P(Z < k) - P(Z > 0.75) = 0.6546$ $1 - P(Z < k) - 0.2266 = 0.6546$ $P(Z < k) = 0.1188$ (ii) $P(Z < -k) = 0.1188$ $-k = 1.181$ $k = -1.181$	1 1 1 1 1 1 1	8				

Bahagian A

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
1	 Perimeter : $x + y + 20 = 48$ $x + y = 28$ $x = 28 - y$ ① Teorem Pythagoras : $x^2 + y^2 = 20^2$ ② ① $\rightarrow$ ②; $(28 - y)^2 + y^2 = 400$ $784 - 56y + y^2 + y^2 - 400 = 0$ $2y^2 - 56y + 384 = 0$ $y^2 - 28y + 192 = 0$ $(y - 16)(y - 12) = 0$ $y = 16, y = 12$ $\therefore$ Panjang sisi yang lain ialah 12 cm dan 16 cm $\therefore$ The length of the other two sides are 12 cm and 16 cm	1 1 1 1 1 1	6
2	(a) Luas $\Delta = \frac{1}{2} \times \text{tapak} \times \text{tinggi}$ $\text{Area } \Delta = \frac{1}{2} \times \text{base} \times \text{height}$ $\frac{1}{2} \times (\sqrt{5} - 1) \times x = 2 + \sqrt{5}$ $x = \frac{2(2 + \sqrt{5})}{\sqrt{5} - 1}$ $x = \frac{4 + 2 + \sqrt{5}}{\sqrt{5} - 1} \times \frac{-\sqrt{5} - 1}{-\sqrt{5} - 1}$ $x = \frac{-4\sqrt{5} - 4 - 2(5) - 2\sqrt{5}}{-5 + 1}$ $x = \frac{-14 - 6\sqrt{5}}{-4}$ $x = \frac{7}{2} + \frac{3}{2}\sqrt{5}$ (b) $\log_2 4x - \log_2 (2x - 4) = 2$ $\log_2 \frac{4x}{2x - 4} = 2 \log_2 2$ $\frac{4x}{2x - 4} = 2^2$ $\frac{4x}{2x - 4} = 4$ $8x - 16 = 4x$ $4x = 16$ $x = 4$	1 1 1 1 1 1	6

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
3	(a) $m_{BT} = \frac{4-0}{7-1} = \frac{2}{3}$ $AT \perp BT \rightarrow m_{AT} \times m_{BT} = -1$ $m_{AT} = -\frac{1}{m_{BT}}$ $m_{AT} = -\frac{1}{\frac{2}{3}}$ $m_{AT} = -\frac{3}{2}$ $\frac{p-4}{5-7} = -\frac{3}{2}$ $2p - 8 = 6$ $p = 7$ (b) $y - 4 = -\frac{3}{2}(x - 7)$ $y = -\frac{3}{2}x + \frac{21}{2} + 4$ $y = -\frac{3}{2}x + \frac{29}{2}$ $2y = -3x + 29$ (c)  $T(7, 4) = \left(\frac{(3)(5) + (2)(x)}{2+3}, \frac{(3)(7) + (2)(y)}{2+3} \right)$ $T(7, 4) = \left(\frac{15+2x}{5}, \frac{21+2y}{5} \right)$ $\frac{15+2x}{5} = 7 \qquad \frac{21+2y}{5} = 4$ $15+2x = 35 \qquad 21+2y = 20$ $2x = 20 \qquad 2y = -1$ $x = 10 \qquad y = -0.5$ $\therefore (10, -0.5)$	1 1 1 1 1 1 1	7
4	(a) $p(x) = -3x^2 + 9x - h$ $= -3\left(x^2 - 3x + \frac{h}{3}\right)$ $= -3\left[x^2 - 3x + \left(-\frac{3}{2}\right)^2 - \left(-\frac{3}{2}\right)^2 + \frac{h}{3}\right]$ $= -3\left[\left(x - \frac{3}{2}\right)^2 - \left(-\frac{3}{2}\right)^2 + \frac{h}{3}\right]$ $= -3\left[\left(x - \frac{3}{2}\right)^2 - \frac{9}{4} + \frac{h}{3}\right]$ $= -3\left(x - \frac{3}{2}\right)^2 + \frac{27}{4} - h \dots\dots\dots \textcircled{1}$ $p(x) = -3(x+k)^2 + \frac{1}{2}(k+1) \dots\dots\dots \textcircled{2}$	1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(c) Luas sektor MON / $Area\ of\ sector\ MON = \frac{1}{2}(36)^2(0.7672)$ $= 497.15\ cm^2$ Luas / $Area\ \triangle NOP = \frac{1}{2}(25)(25)(\sin 43.95^\circ)$ $= 216.88\ cm^2$ Luas lorekan / $Area\ shaded = 497.15\ cm^2 - 216.88\ cm^2$ $= 280.27\ cm^2$	1 1 1 1	9
6	(a) Bilangan batang mancis / $Number\ of\ matchsticks :$ $3, 5, 7, 9, \dots$ $d_1 = 5 - 3 = 2$ $d_2 = 7 - 5 = 2$ $d_3 = 9 - 7 = 2$ $\therefore d_1 = d_2 = d_3 = 2$ $\therefore$ Jajjang aritmetik dengan beza sepunya ialah 2 $\therefore$ Arithmetic progression with common difference of 2 (b) $S_n = 575$ $\frac{n}{2}[(2)(3) + (n-1)(2)] = 575 \leftarrow S_n = \frac{n}{2} [2a + (n-1)d]$ $n(4 + 2n) = 1150$ $2n^2 + 4n - 1150 = 0$ $n^2 + 2n - 575 = 0$ $(n-23)(n+25) = 0$ $n-23 = 0 \qquad n+25 = 0$ $n = 23 \qquad n = -25\ (Abai / Ignore)$ Bilangan maksimum segi tiga ialah 23 $Maximum\ number\ of\ triangles\ is\ 23$ (c) Luas / $Area\ \triangle = \frac{1}{2}(4)(4)(\sin 60^\circ) \leftarrow \Delta L = \frac{1}{2} ab \sin C$ $= 6.928\ cm^2$ Jumlah luas / $Total\ area = 23 \times 6.928\ cm^2$ $= 159.34\ cm^2$	1 1 1 1 1 1 1 1	8
7	  $\cos(A - B) = \cos A \cos B - \sin A \sin B$ $\cos(A - B) = \cos A \cos B - \sin A \sin B$ $= \left(\frac{3}{p}\right)\left(\frac{5}{13}\right) - \left(\frac{-\sqrt{p^2-9}}{p}\right)\left(-\frac{12}{13}\right)$ $= \frac{15 - 12\sqrt{p^2-9}}{13p}$	1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(c) Isi padu janaan / The generated volume $= \pi \int_0^6 (x+2)^2 dx - \pi \int_0^4 (4-x) dx$ $= \pi \left[\frac{(x+2)^3}{3} \right]_0^6 - \pi \left[4x - \frac{x^2}{2} \right]_0^4$ $= \pi \left[\frac{(6+2)^3}{3} - \frac{(0+2)^3}{3} \right] - \pi \left\{ \left[4(4) - \frac{(4)^2}{2} \right] - \left[4(0) - \frac{(0)^2}{2} \right] \right\}$ $= \pi \left(170\frac{2}{3} - 2\frac{2}{3} \right) - \pi(8-0)$ $= 160 \pi \text{ unit}^3$	1 1 1 1	10
9	(a) (i) $\overrightarrow{AP} = \overrightarrow{AQ} + \overrightarrow{QP}$ $\overrightarrow{AP} = 4\tilde{x} - 6\tilde{y}$ (ii) $\overrightarrow{CP} = \frac{1}{3}\overrightarrow{RP}$ $= \frac{1}{3}(\overrightarrow{RQ} + \overrightarrow{QP})$ $= \frac{1}{3}(3\overrightarrow{AQ} + \overrightarrow{QP})$ $= \frac{1}{3}(12\tilde{x} - 6\tilde{y})$ $= 4\tilde{x} - 2\tilde{y}$ (b) $\overrightarrow{CP} = 4\tilde{x} - 2\tilde{y}$ $\overrightarrow{CP} = 4(2\tilde{i}) - 2(\tilde{i} + 3\tilde{j})$ $= 8\tilde{i} - 2\tilde{i} - 6\tilde{j}$ $= 6\tilde{i} - 6\tilde{j}$ $ \overrightarrow{CP} = \sqrt{6^2 + (-6)^2}$ $= \sqrt{72} \text{ unit}$ (c) $\overrightarrow{AB} = k\overrightarrow{AP}$ $\overrightarrow{AB} = k(4\tilde{x} - 6\tilde{y}) \dots\dots\dots \textcircled{1}$ $\overrightarrow{QC} = \overrightarrow{QP} + \overrightarrow{PC}$ $= -6\tilde{y} + (-(4\tilde{x} - 2\tilde{y}))$ $= -6\tilde{y} - 4\tilde{x} + 2\tilde{y}$ $= -4\tilde{x} - 4\tilde{y}$ $\overrightarrow{QB} = m\overrightarrow{QC}$ $= m(-4\tilde{x} - 4\tilde{y})$	1 1 1 1 1 1 1	

[illegible]

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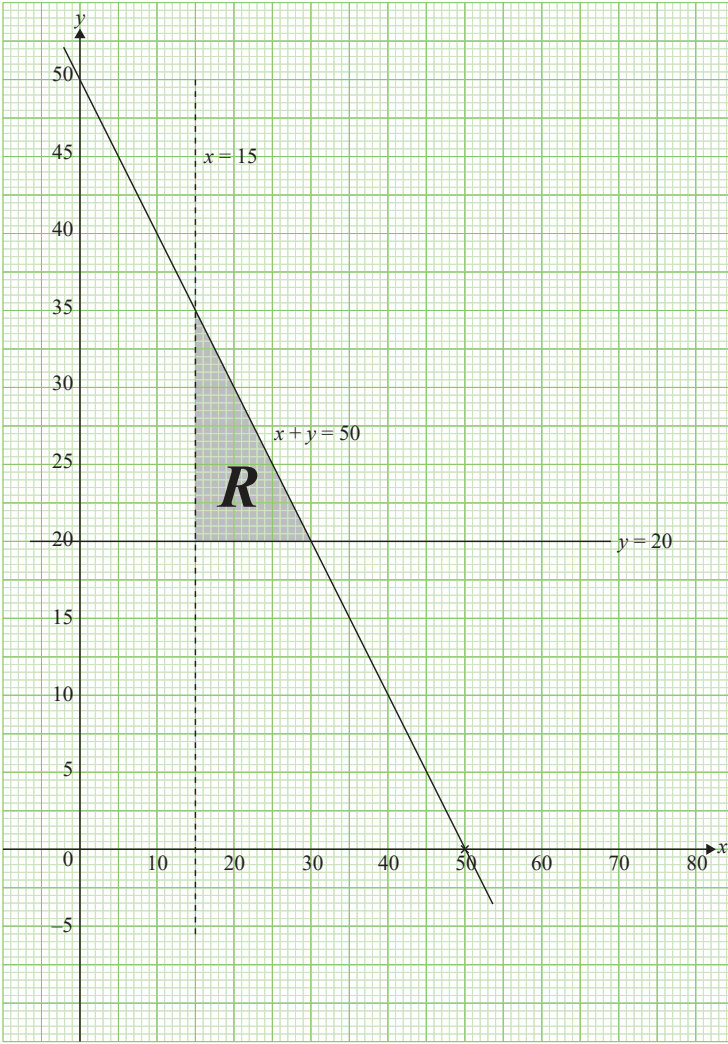
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) (i) $x = 3.5 \rightarrow x^2 = 12.25$ Daripada graf / From the graph : Apabila / When $x^2 = 12.25$, $\frac{y}{x} = 14.25$ $\frac{y}{3.5} = 14.25$ $y = 49.875$ (ii) $y = px^3 + qx$ $\frac{y}{x} = px^2 + q$ $Y = mX + C$ $p = m$ $p = \frac{32.5 - 25}{24.5 - 19.5}$ $p = 1.5$ $q = C$ $q = -4.2$	1 1 1 1 1 1	10

Bahagian C

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
12	(a) (i) $\frac{3.60}{P_{2018}} \times 100 = 120$ $P_{2018} = \frac{3.60 \times 100}{120}$ $P_{2018} = \text{RM}3.00$ (ii) $\frac{P_{2020}}{8} \times 100 = 110$ $P_{2020} = \frac{110 \times 8}{100}$ $P_{2020} = \text{RM}8.80$ (b) (i) $I_{2020/2018} = 140$ $\frac{(110)(2) + (128)(1) + (120)(3) + (x)(4)}{2 + 1 + 3 + 4} = 140$ $4x + 708 = 1400$ $4x = 692$ $x = 173$ (ii) $I_{2022/2018} = \frac{(113)(2) + (128)(1) + (127)(3) + (178)(4)}{2 + 1 + 3 + 4}$ $I_{2022/2018} = 144.7$	1 1 1 1 1 2 1	

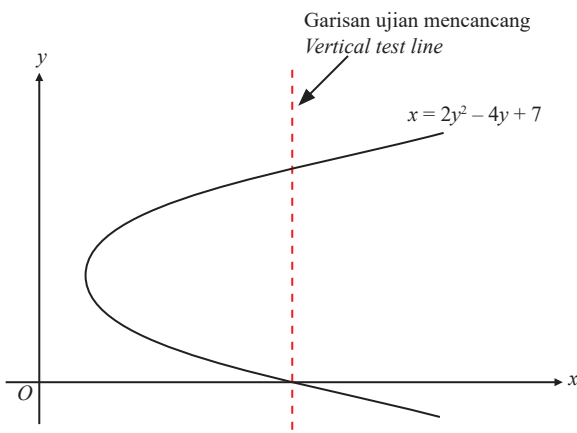
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(c) $\frac{P_{2022}}{20} \times 100 = 144.7$ $P_{2022} = \frac{144.7 \times 20}{100}$ $P_{2022} = \text{RM}28.94$	1 1	10
13	(a) $s = \frac{5.2 + 4.3 + 6.8}{2}$ $s = 8.15 \text{ cm}$ Luas / Area = $\sqrt{8.15(8.15 - 5.2)(8.15 - 4.3)(8.15 - 6.8)}$ $= \sqrt{124.9609}$ $= 11.18 \text{ cm}^2$ (b) (i) $(4.3)^2 + (5.2)^2 - 2(4.3)(5.2) \cos \angle ADC = (6.8)^2$ $45.53 - 44.72 \cos \angle ADC = 46.24$ $\cos \angle ADC = -0.01588$ $\angle ADC = \cos^{-1}(-0.01588)$ $\angle ADC = 90.91^\circ$ (ii) $\angle ABC = 180^\circ - 90.91^\circ$ $\angle ABC = 89.09^\circ$ $\frac{\sin \angle BCA}{5.8} = \frac{\sin 89.09^\circ}{6.8}$ $\angle BCA = \sin^{-1}(0.8528)$ $\angle BCA = 58.52^\circ$ $\angle BAC = 180^\circ - 58.52^\circ - 89.09^\circ$ $\angle BAC = 32.39^\circ$ $BC^2 = (5.8)^2 + (6.8)^2 - 2(5.8)(6.8) \cos 32.39^\circ$ $BC = \sqrt{13.2720}$ $BC = 3.643 \text{ cm}$	1 1 1 1 1 1 1 1 1 1 1	10
14	(a) Pecutan awal / Initial acceleration $\rightarrow t = 0$ $\therefore a = 2(0) - 6$ $a = 6 \text{ m s}^{-2}$ (b) $v = \int a \, dt$ $v = \int (2t - 6) \, dt$ $v = \frac{2t^2}{2} - 6t + c$ $v = t^2 - 6t + c ; \text{ bila / when } t = 0, v = 8$ $8 = (0)^2 - 6(0) + c$ $8 = c$ $\therefore v = t^2 - 6t + 8$ Halaju minimum / Minimum velocity $\rightarrow a = 0$ $2t - 6 = 0$ $t = 3$	1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	Apabila / When $t = 3$ $v = t^2 - 6t + 8$ $v = (3)^2 - 6(3) + 8$ $v = -1 \text{ ms}^{-1}$ (c) Berhenti seketika / Stops instantaneously $\rightarrow v = 0$ $t^2 - 6t + 8 = 0$ $(t - 4)(t - 2) = 0$ $t = 4, t = 2$ (d) $s = \int v dt$ $s = \int_0^2 (t^2 - 6t + 8) dt + \left \int_2^3 (t^2 - 6t + 8) dt \right$ $= \left[\frac{t^3}{3} - 3t^2 + 8t \right]_0^2 + \left \left[\frac{t^3}{3} - 3t^2 + 8t \right]_2^3 \right$ $= \left\{ \left[\frac{(2)^3}{3} - 3(2)^2 + 8(2) \right] - \left[\frac{(0)^3}{3} - 3(0)^2 + 8(0) \right] \right\}$ $+ \left \left\{ \left[\frac{(3)^3}{3} - 3(3)^2 + 8(3) \right] - \left[\frac{(2)^3}{3} - 3(2)^2 + 8(2) \right] \right\} \right$ $= 6\frac{2}{3} + \left 6 - 6\frac{2}{3} \right$ $= 6\frac{2}{3} + \frac{2}{3}$ $s = 7\frac{1}{3} \text{ m}$	1 1 1 1 1 1 1 1 1 1 1	10
15	(a) I $x + y \leq 50$ II $x > 15$ III $y \geq 20$	1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b)  (c) (i) Bila / When $x = 23$, $20 \leq y \leq 27$ (ii) Yuran bulanan / Monthly fee = $100x + 120y$ Titik optimum ialah / The optimal point is (15, 35) Keuntungan maksimum / Maximum profit = RM100(15) + RM120(35) = RM5 700	4 1 1	10

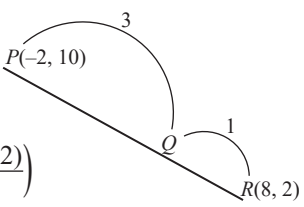
KERTAS 1

Bahagian A

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
1	(a) (i) $f(x) = \frac{2x-1}{2}$ $f^2(x) = f\left(\frac{2x-1}{2}\right)$ $= \frac{2\left(\frac{2x-1}{2}\right) - 1}{2}$ $= \frac{2x-2}{2}$ $= x-1$	1	
		1	
	(ii) $\frac{2x-1}{2} = y$ $2x-1 = 2y$ $2x = 2y+1$ $x = \frac{2y+1}{2}$ $f^{-1}(x) = \frac{2x+1}{2} \text{ atau / or } f^{-1}(x) = x + \frac{1}{2}$	1	
		1	
	(b)  Bukan fungsi, kerana garisan ujian mencancang bersilang pada 2 titik. Not a function, because the vertical test line intersect at 2 points.	1	
			6

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
2	(a) $f(x) = m\left(x^2 + \frac{6}{m}x - \frac{k}{m}\right)$ $= m\left[x^2 + \frac{6}{m}x + \left(\frac{6}{2m}\right)^2 - \left(\frac{6}{2m}\right)^2 - \frac{k}{m}\right]$ $= m\left[x^2 + \frac{6}{m}x + \left(\frac{3}{m}\right)^2 - \left(\frac{3}{m}\right)^2 - \frac{k}{m}\right]$ $= m\left[\left(x + \frac{3}{m}\right)^2 - \frac{9}{m^2} - \frac{k}{m}\right]$ $= m\left(x + \frac{3}{m}\right)^2 - \frac{9}{m} - k$ Ditunjukkan / Shown (b) $x + \frac{3}{m} = 0$ $x = -\frac{3}{m}$ $6 = -\frac{3}{m}$ $m = -\frac{1}{2}$ $-\frac{9}{m} - k = 13$ $-\frac{9}{-\frac{1}{2}} - k = 13$ $18 - k = 13$ $k = 5$	1 1 1 1 1 1	6
3	(a) $441^x(21^{2-x}) = (7^2 \times 3^2)^x(7 \times 3)^{2-x}$ $= (7^x)^2(3^x)^2\left(\frac{7^2}{7^x}\right)\left(\frac{3^2}{3^x}\right)$ $= (n^2)(m^2)\left(\frac{49}{n}\right)\left(\frac{9}{m}\right)$ $= 441mn$ (b) $b^{\log_b k} = 32$ $\log_b b^{\log_b k} = \log_b 32$ $(\log_b k)(\log_b b) = \log_b 32$ $\log_b k = \log_b 32$ $k = 32$	1 1 1 1 1 1	5
4	(a) $1.040404... = 1 + 0.04 + 0.0004 + 0.000004 + ...$ $a = 0.04$ $r = \frac{0.0004}{0.04}$ $= 0.01$ $S_\infty = \frac{a}{1-r}$ $S_\infty = \frac{0.04}{1-0.01}$ $= \frac{0.04}{0.09}$ $= \frac{4}{99}$ $\therefore 1.040404... = 1 + \frac{4}{99} = 1\frac{4}{99}$	1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) $d_1 = d_2$ $(5x - 1) - (37 - 3x) = (37 - 3x) - (27 + x)$ $5x - 1 - 37 + 3x = 37 - 3x - 27 - x$ $-38 + 8x = 10 - 4x$ $12x = 48$ $x = 4$	1 1	 5
5	$\theta = 2\pi - 1.047$ $= 2(3.142) - 1.047$ $= 5.237$ Perimeter = 110 cm $MO + ON + S_{OMN} = 110$ $j + j + j(5.237) = 110$ $7.237j = 110$ $j = 15.20$ cm Luas / Area = $\frac{1}{2}j^2\theta$ $= \frac{1}{2} \times (15.20)^2(5.237)$ $= 604.98 \text{ cm}^2$	1 1 1	 4
6	(a) $\frac{y}{x} = kx^2$ $y = kx^3$ $\log_{10} y = \log_{10} kx^3$ $\log_{10} y = \log_{10} k + 3\log_{10} x$ $\log_{10} y = 3\log_{10} x + \log_{10} k$ $Y = mX + C$ (b) $\log_{10} k = 3$ $k = 10^3$ $k = 1000$ $\frac{7-3}{h-0} = 3$ $3h = 4$ $h = \frac{4}{3}$	 1 1 1	 5
7	(a) $\frac{dp}{ds} = 2s$ (b) $p = s^2 - 9$ $s^2 = p + 9$ $\frac{dp}{dt} = \frac{dp}{ds} \times \frac{ds}{dt}$ $= 2s \times \frac{1}{36s^3}$ $= \frac{1}{18s^2}$ $= \frac{1}{18(p+9)}$	1 1 1 1	 4

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) $\int_1^4 2mx \, dx - \int_4^1 f(x) \, dx = 27$ $\left[\frac{2mx^2}{2}\right]_1^4 + \int_1^4 f(x) \, dx = 27$ $[mx^2]_1^4 + (-3) = 27$ $m(4)^2 - m(1)^2 - 3 = 27$ $16m - m = 30$ $15m = 30$ $m = 2$	1 1 1	6
11	(a) $Q(x, y) = \left(\frac{nx_1 + mx_2}{m+n}, \frac{ny_1 + my_2}{m+n}\right)$ $PQ = 3QR$ $\frac{PQ}{QR} = \frac{3}{1}$ $Q(x, y) = \left(\frac{(-2)(1) + (3)(8)}{3+1}, \frac{(1)(10) + (3)(2)}{3+1}\right)$ $= \left(\frac{11}{2}, 4\right)$ (b) $m_{PR} = \frac{10-2}{-2-8} \leftarrow m = \frac{y_2 - y_1}{x_2 - x_1}$ $m_{PR} = -\frac{4}{5}$ $\perp : m_1 m_2 = -1$ $\frac{-4}{5} \times m_2 = -1$ $m_2 = \frac{5}{4}$ Persamaan garis lurus melalui $Q \perp PR$ Equation of straight line passes $Q \perp PR$ $y - 4 = \frac{5}{4}\left(x - \frac{11}{2}\right)$ $y = \frac{5}{4}x - \frac{55}{8} + 4$ $y = \frac{5}{4}x - \frac{23}{8}$ $8y = 10x - 23$ 	1 1 1 1 1 1	5
12	(a) Min / Mean: $np = 750$ ① Varians / Variance: $np = 450$ ② ① $\rightarrow$ ②; $750q = 450$ $q = 0.6$ $p = 1 - 0.6$ $p = 0.4$ Peratus yang berbasikal / The percentage who cycle = $0.4 \times 100\%$ $= 40\%$	1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
14	Sebutan pertama / 1st term $a = 86$ cm Beza sepunya / Common difference $d = -6$ cm (a) $T_8 = 86 + (8 - 1)(-6)$ $\leftarrow T_n = a + (n - 1)d$ $= 44$ Jejari / Radius = $44 \text{ cm} \div 2$ $= 22$ cm Luas / Area = $\pi(22 \text{ cm})^2$ $= 484\pi \text{ cm}^2$ (b) $T_n > 0$ $86 + (n - 1)(-6) > 0$ $-6n + 6 > -86$ $-6n > -92$ $n > 15.33$ $\therefore n = 15$ (c) $T_{15} = 86 + (15 - 1)(-6) = 2$ cm Jejari / Radius = $2 \text{ cm} \div 1$ cm Luas bulatan / Area of circle $= \pi r^2 / \pi r^2$	1 1 1 1 1 1 1 1	8
15	(a) (i) $\overrightarrow{CA} = \overrightarrow{CB} + \overrightarrow{BA}$ $\overrightarrow{CA} = -12\hat{y} - 8\hat{x}$ (ii) $\overrightarrow{TB} = \overrightarrow{TA} + \overrightarrow{AB}$ $\overrightarrow{TB} = \frac{1}{4}\overrightarrow{CA} + \overrightarrow{AB}$ $\overrightarrow{TB} = \frac{1}{4}(-12\hat{y} - 8\hat{x}) + 8\hat{x}$ $\overrightarrow{TB} = 6\hat{x} - 3\hat{y}$ (b) $\overrightarrow{DB} = \overrightarrow{DA} + \overrightarrow{AB}$ $\overrightarrow{DB} = 5\hat{y} + m\hat{x} + 8\hat{x}$ $\overrightarrow{TB} = k\overrightarrow{DB}$ $6\hat{x} - 3\hat{y} = k(5\hat{y} + m\hat{x} + 8\hat{x})$ $5k\hat{y} = -3\hat{y}$ $k = -\frac{3}{5}$ $6\hat{x} = k(m + 8)\hat{x}$ $6 = -\frac{3}{5}(m + 8)$ $-10 = m + 8$ $m = -18$	1 1 1 1 1 1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
1	(a) $3(5^m) = 2\,500 - 5^m$ $3(5^m) + 5^m = 2\,500$ $4(5^m) = 2\,500$ $5^m = \frac{2\,500}{4}$ $5^m = 625$ $5^m = 5^4$ $m = 4$ (b) $2x + 4y - z = \frac{1}{2} \dots\dots\dots \textcircled{1}$ $4x + 5y - 2z = -7 \dots\dots\dots \textcircled{2}$ $x - 3y - z = \frac{1}{3} \dots\dots\dots \textcircled{3}$ Daripada / From $\textcircled{3}$, $z = x - 3y - \frac{1}{3} \dots\dots\dots \textcircled{4}$ Ganti $\textcircled{4}$ dalam $\textcircled{1}$ / Substitute $\textcircled{4}$ into $\textcircled{1}$ $2x + 4y - (x - 3y - \frac{1}{3}) = \frac{1}{2}$ $x + 7y + \frac{1}{3} = \frac{1}{2}$ $x = \frac{1}{6} - 7y \dots\dots\dots \textcircled{5}$ Ganti $\textcircled{4}$ & $\textcircled{5}$ ke dalam $\textcircled{2}$ / Substitute $\textcircled{4}$ & $\textcircled{5}$ into $\textcircled{2}$ $4(\frac{1}{6} - 7y) + 5y - 2(\frac{1}{6} - 7y - 3y - \frac{1}{3}) = 7$ $4(\frac{1}{6} - 7y) + 5y - 2(\frac{1}{6} - 10y) = -7$ $\frac{4}{6} - 28y + 5y + \frac{1}{3} + 20y = -7$ $-3y = -7 - 1$ $y = \frac{8}{3} / 2\frac{2}{3}$ Ganti $y = \frac{8}{3}$ ke dalam $\textcircled{5}$ / Substitute $y = \frac{8}{3}$ into $\textcircled{5}$ $x = \frac{1}{6} - 7(\frac{8}{3})$ $x = -\frac{37}{2} / -18\frac{1}{2}$ Ganti $x = -\frac{37}{2}$ dan / and $y = \frac{8}{3}$ ke dalam / into $\textcircled{4}$ $z = -\frac{37}{2} - 3(\frac{8}{3}) - \frac{1}{3}$ $z = -\frac{37}{2} - 8 - \frac{1}{3}$ $z = -\frac{161}{6} / -26\frac{5}{6}$ $x = -18\frac{1}{2}$; $y = \frac{8}{3}$; $z = -26\frac{5}{6}$	1 1 1 1 1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
3	(a) $S_1 = 16(2^1 - 1)$ $S_1 = 16$	1	8
	(b) $S_{17} = 16(2^{17} - 1)$ $S_{17} = 2\,097\,136$	1	
	$S_{13} \rightarrow 17 = S_{17} - S_{12}$ $= 2\,097\,136 - 65\,520$ $= 2\,031\,616$	1 1	
	(c) $S_2 = 16(2^2 - 1)$ $= 48$	1	
	$T_2 = S_2 - S_1$ $= 48 - 16$ $= 32$	1	
	$r = \frac{T_2}{T_1}$ $= \frac{32}{16}$ $= 2$	1 1	
4	(a) $\frac{\text{panjang lengkok } PQ}{\theta} = \frac{\text{lilitan bulatan}}{2\pi}$ $\frac{\text{length arc } PQ}{\theta} = \frac{\text{circumference}}{2\pi}$		8
	$\frac{s}{\theta} = \frac{2\pi r}{2\pi}$ $s = \frac{\theta \times 2\pi r}{2\pi}$ $s = r\theta$	1 1	
	$\therefore$ Ditunjukkan / Shown		
	(b) (i) Perimeter $= s_{AB} + s_{DC \text{ major}} + AC + BD$ $= (5 + 5)(\theta) + (5)(2\pi - \theta) + 5 + 5$ $= 10\theta + 10\pi - 5\theta + 10$ $= (5\theta + 10\pi + 10) \text{ cm}$	1 1 1	
	(ii) Luas / Area $= AOB + DOC_{\text{major}}$ $= \frac{1}{2}(5 + 5)^2(\theta) + \frac{1}{2}(5)^2(2\pi - \theta)$ $= 50\theta + \frac{25}{2}(2\pi - \theta)$ $= 50\theta + 25\pi - \frac{25}{2}\theta$ $= \left(\frac{75}{2}\theta + 25\pi\right) \text{ cm}^2$	1 1 1	
	Luas sektor Area of sector $= \frac{1}{2}r^2\theta / \frac{1}{2}r^2\theta$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
5	(a) $\overrightarrow{OA} = 2\hat{i} + 3\hat{j}$; $\overrightarrow{OB} = -4\hat{i} + 7\hat{j}$ $\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$ $= -(2\hat{i} + 3\hat{j}) + (-4\hat{i} + 7\hat{j})$ $= -2\hat{i} - 3\hat{j} - 4\hat{i} + 7\hat{j}$ $= -6\hat{i} + 4\hat{j}$ $\left \overrightarrow{AB} \right = \frac{\overrightarrow{AB}}{ \overrightarrow{AB} } = \frac{x\hat{i} + y\hat{j}}{\sqrt{x^2 + y^2}}$ $\left \overrightarrow{AB} \right = \frac{(-6\hat{i} + 4\hat{j})}{\sqrt{(-6)^2 + (4)^2}}$ $= \frac{(-6\hat{i} + 4\hat{j})}{\sqrt{52}}$ $\sqrt{52} = \sqrt{4 \times 13}$ $= \frac{-6\hat{i} + 4\hat{j}}{2\sqrt{13}}$ $= \frac{-3\hat{i} + 2\hat{j}}{\sqrt{13}}$ (b) $\overrightarrow{AK} = 3\overrightarrow{KB}$ $\overrightarrow{AO} + \overrightarrow{OK} = 3(\overrightarrow{KO} + \overrightarrow{OB})$ $\overrightarrow{AO} + \overrightarrow{OK} = 3\overrightarrow{KO} + 3\overrightarrow{OB}$ $\overrightarrow{OK} - 3\overrightarrow{KO} = 3\overrightarrow{OB} - \overrightarrow{AO}$ $\overrightarrow{OK} + 3\overrightarrow{OK} = 3(-4\hat{i} + 7\hat{j}) - (-2\hat{i} - 3\hat{j})$ $4\overrightarrow{OK} = -12\hat{i} + 21\hat{j} + 2\hat{i} + 3\hat{j}$ $4\overrightarrow{OK} = -10\hat{i} + 24\hat{j}$ $\overrightarrow{OK} = -\frac{5}{2}\hat{i} + 6\hat{j}$	1 1 1 1 1 1 1 1	6
6	(a) $x = y^2 - 6y + 12$ ① $x + y^2 = 5y$ ② Ganti ① dalam ② / Substitute ① into ② ; $y^2 - 6y + 12 + y^2 = 5y$ $2y^2 - 11y + 12 = 0$ $(2y - 3)(y - 4) = 0$ $2y - 3 = 0$ $y - 4 = 0$ $y = \frac{3}{2}$ $y = 4$ Dari ①, apabila / From ①, when $y = 4$; $x = (4)^2 - 6(4) + 12$ $x = 4$ $\therefore A(4, 4)$ Dari 1, apabila / From ①, when $y = \frac{3}{2}$ $x = \left(\frac{3}{2}\right)^2 - 6\left(\frac{3}{2}\right) + 12$ $x = 5\frac{1}{4}$ $\therefore B\left(5\frac{1}{4}, 1\frac{1}{2}\right)$	1 1 1	

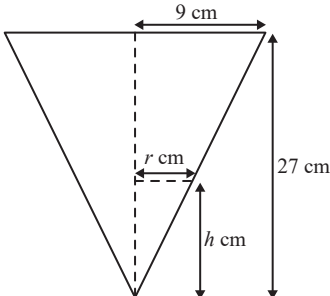
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks								
	(b) $\left[\frac{x}{2\pi} + \sin\left(\frac{3}{2}x\right) - \frac{3}{2} = 0 \right] \times 2$ $\frac{x}{\pi} + 2 \sin\left(\frac{3}{2}x\right) - 3 = 0$ $\frac{x}{\pi} + y - 3 = 0$ $y = 3 - \frac{x}{\pi}$ Untuk melakar / To sketch $= 3 - \frac{x}{\pi}$ <table border="1"> <tr> <td>x</td><td>0</td><td>π</td><td>2π</td></tr> <tr> <td>y</td><td>3</td><td>2</td><td>1</td></tr> </table> Bilangan penyelesaian / Number of solutions: 2	x	0	π	2π	y	3	2	1	1	
x	0	π	2π								
y	3	2	1								
		1									
		1	6								

Bahagian B

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
8	(a) (i) $P(X=5) = 0.1160$ ${}^5C_5(p)^5(1-p)^0 = 0.1160$ $p^5 = 0.1160$ $p = \sqrt[5]{0.1160}$ $p = 0.65$ (ii) $1 - P(X \geq 3) = P(X=0) + P(X=1) + P(X=2)$ $= {}^5C_0(0.65)^0(0.35)^5 + {}^5C_1(0.65)^1(0.35)^4$ $+ {}^5C_2(0.65)^2(0.35)^3$ $= 0.005252 + 0.04877 + 0.1811$ $= 0.2351$	1	
		1	
		1	
		1	
		1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) (i) $Z = \frac{X - \mu}{\sigma}$ $P(1.1 < X < 2.3) = P\left(\frac{1.1 - 1.3}{\sqrt{0.54}} < Z < \frac{2.3 - 1.3}{\sqrt{0.54}}\right)$ $= P(-0.272 < Z < 1.361)$ $= P(Z > -0.272) - P(Z > 1.361)$ $= 1 - P(Z > -0.272) - P(Z > 1.361)$ $= 1 - 0.3928 - 0.0867$ $= 0.5205$ (ii) $P(X > h) = 0.3550$ $P\left(Z > \frac{h - 1.3}{\sqrt{0.54}}\right) = 0.3550$ $\frac{h - 1.3}{\sqrt{0.54}} = 0.372$ $h - 1.3 = 0.2734$ $h = 1.5734$ 0.372 ialah nilai z dalam sifir taburan normal piawai 0.372 is the z-score obtained from the standard normal distribution table	1 1 1 1 1 1	10
9	(a) $m_{OT} = \frac{1 - 0}{2 - 0} = \frac{1}{2}$ $OT \perp OR \rightarrow m_{OT} \times m_{OR} = -1$ $\left(\frac{1}{2}\right) \times m_{OR} = -1$ $m_{OR} = -2$ Persamaan OR / Equation of OR : $y - 0 = -2(x - 0)$ $y = -2x$ ① Persamaan RS / Equation of RS : $y - 2x = 20$ ② Ganti ① dalam ② / Substitute ① into ② ; $-2x - 2x = 20$ $-4x = 20$ $x = -5$ Dari / From ① ; $y = -2(-5)$ $= 10$ $\therefore R(-5, 10)$ (b) $(x, y) = \left(\frac{nx_1 + mx_2}{m + n}, \frac{ny_1 + my_2}{m + n}\right)$ $A(-1, 12) = \left(\frac{(3)(-5) + (2)(x)}{2 + 3}, \frac{(3)(10) + (2)(y)}{2 + 3}\right)$ $A(-1, 12) = \left(\frac{-15 + 2x}{5}, \frac{30 + 2y}{5}\right)$ $\frac{-15 + 2x}{5} = -1 \quad \frac{30 + 2y}{5} = 12$ $-15 + 2x = -5 \quad 30 + 2y = 60$ $2x = 10 \quad 2y = 30$ $x = 5 \quad y = 15$ $\therefore S(5, 15)$	1 1 1 1 1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks														
	Luas / Area = $\frac{1}{2} \begin{vmatrix} 0 & -5 & 5 & 2 & 0 \\ 0 & 10 & 15 & 1 & 0 \end{vmatrix}$ $= \frac{1}{2} \left \begin{aligned} &[(0)(10) + (-5)(15) + (5)(1) + (2)(0)] \\ &-[(0)(-5) + (10)(5) + (15)(2) + (1)(0)] \end{aligned} \right$ $= \frac{1}{2} -70-80$ $= 75 \text{ unit}^2$ (c) $SH = 5$ $\sqrt{(x - x_1)^2 + (y - y_1)^2} = r$ $\sqrt{(x - 5)^2 + (y - 15)^2} = 5$ $x^2 - 10x + 25 + y^2 - 30y + 225 = 25$ $x^2 + y^2 - 10x - 30y + 25 + 225 - 25 = 0$ $x^2 + y^2 - 10x - 30y + 225 = 0$ <td> 1 1 1 1 </td> <td> 10 </td>	1 1 1 1	10														
10	(a) <table><tr><td>x^2</td><td>1</td><td>4</td><td>9</td><td>16</td><td>25</td><td>36</td></tr><tr><td>xy</td><td>2</td><td>-7</td><td>-21.99</td><td>-43</td><td>-70</td><td>-103.02</td></tr></table> <td> 1 3 </td> <td></td>	x^2	1	4	9	16	25	36	xy	2	-7	-21.99	-43	-70	-103.02	1 3	
x^2	1	4	9	16	25	36											
xy	2	-7	-21.99	-43	-70	-103.02											

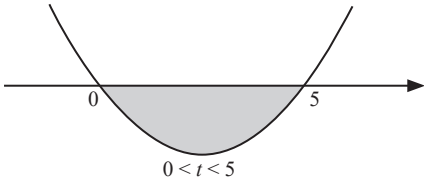
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) (i) Dari graf / <i>From the graph</i> : Apabila / <i>When</i> $xy = -25$, $x^2 = 10$, $xy = -25$ $(\sqrt{10})y = -25$ $y = -\frac{25}{\sqrt{10}}$ (ii) $y = ax + \frac{b}{x}$ $xy = ax^2 + b$ $Y = mX + C$ $a = m$ $a = \frac{-85 - (-10)}{30 - 5}$ $a = -3$ $b = C$ $b = 5$	1 1 1 1 1 1	10
11	(a)  $\frac{j}{t} = \frac{9}{27}$ $j = \frac{1}{3}t$ $V = \frac{1}{3}\pi\left(\frac{1}{3}t\right)^2 t$ $V = \frac{1}{27}\pi t^3$ (Ditunjukkan / <i>Shown</i>) $\frac{r}{h} = \frac{9}{27}$ $r = \frac{1}{3}h$ $V = \frac{1}{3}\pi\left(\frac{1}{3}h\right)^2 h$ $V = \frac{1}{27}\pi h^3$ (b) $I = \frac{1}{27}\pi t^3$ $\frac{dI}{dt} = (3)\left(\frac{1}{27}\right)\pi t^{3-1}$ $\frac{dI}{dt} = \frac{1}{9}\pi t^2$ $V = \frac{1}{27}\pi h^3$ $\frac{dV}{dh} = (3)\left(\frac{1}{27}\right)\pi h^{3-1}$ $\frac{dV}{dh} = \frac{1}{9}\pi h^2$	1 1 1 1	

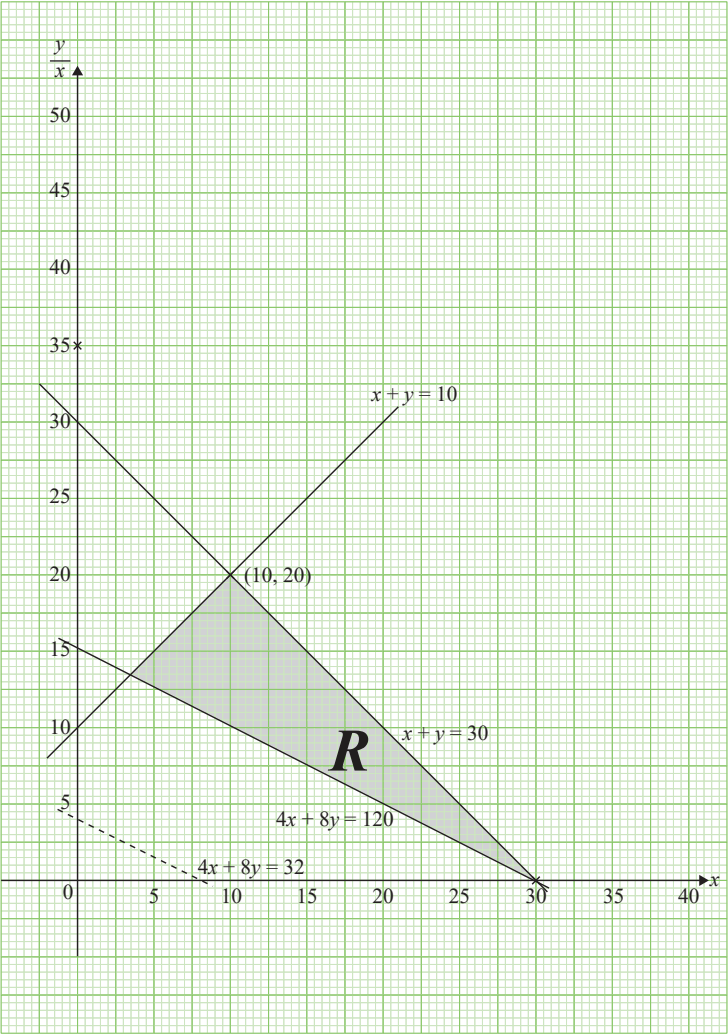
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	Apabila $t = 5$ cm; $\frac{dI}{dt} = \frac{1}{9}\pi(5)^2$ $= \frac{25}{9}\pi$ $\delta I \approx \frac{dI}{dt} \times \delta t$ $= \frac{25}{9}\pi \times (5.5 - 5)$ $= 1\frac{7}{18}\pi \text{ cm}^3$	When $h = 5$ cm; $\frac{dV}{dh} = \frac{1}{9}\pi(5)^2$ $= \frac{25}{9}\pi$ $\delta V \approx \frac{dV}{dh} \times \delta h$ $= \frac{25}{9}\pi \times (5.5 - 5)$ $= 1\frac{7}{18}\pi \text{ cm}^3$	1 1
(c)	$j = \frac{1}{3}t$ $2.6 = \frac{1}{3}t$ $7.8 = t$ Apabila $t = 7.8$ cm; Katakan $t = x$ $\frac{dI}{dx} = \frac{1}{9}\pi(7.8)^2$ $= 6.76\pi$ $\frac{dI}{dt} = 3.5(3.142) - 6$ $= 4.997$ $\frac{dx}{dt} = \frac{dx}{dI} \times \frac{dI}{dt}$ $= \frac{1}{6.76(3.142)} \times 4.997$ $= 0.2353 \text{ cm s}^{-1}$	$r = \frac{1}{3}h$ $2.6 = \frac{1}{3}h$ $7.8 = h$ When $h = 7.8$ cm; $\frac{dV}{dh} = \frac{1}{9}\pi(7.8)^2$ $= 6.76\pi$ $\frac{dV}{dt} = 3.5(3.142) - 6$ $= 4.997$ $\frac{dh}{dt} = \frac{dh}{dV} \times \frac{dV}{dt}$ $= \frac{1}{6.76(3.142)} \times 4.997$ $= 0.2353 \text{ cm s}^{-1}$	1 1 1 1 1
			10

Bahagian C

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
12	(a) $I = \frac{Q}{Q_0} \times 100$ $\frac{m}{25.50} \times 100 = 115$ $m = 29.33$ $\frac{33}{n} \times 100 = 135$ $n = 24.44$ $p = \frac{22.50}{18.75} \times 100$ $p = 120$ $\therefore m = 29.33, n = 24.44, p = 120$	1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) $\bar{I} = \frac{\sum I_i w_i}{\sum w_i}$ $\bar{I}_{15/12} = \frac{(115)(500) + (123)(650) + (135)(700) + (120)(350)}{500 + 650 + 700 + 350}$ $\bar{I}_{15/12} = 124.52$ (c) $\frac{Q_{2015}}{45\,000} \times 100 = 124.52$ $Q_{2015} = \frac{124.52 \times 45\,000}{100}$ $Q_{2015} = \text{RM}56\,034$ (d) $I_{2018/2015} = 110$ $\bar{I}_{2018/2012} = \frac{I_{2018}}{I_{2015}} \times \frac{I_{2015}}{I_{2012}} \times 100$ $\bar{I}_{2018/2012} = \frac{110}{100} \times \frac{124.52}{100} \times 100$ $\bar{I}_{2018/2012} = 136.972$	1 1 1 1 1 1 1 1	10
13	(a) $DE^2 = (35)^2 + (5)^2 - 2(35)(5) \cos 120^\circ$ $DE = \sqrt{1425}$ $DE = 37.75 \text{ cm}$ (b) $\frac{\sin \angle PDE}{30} = \frac{\sin 120^\circ}{37.75}$ $\angle PDE = \sin^{-1}(0.6882)$ $\angle PDE = 43.49^\circ$ (c) $\text{Luas / Area} = \frac{1}{9}(37.75)(37.75)\sin 60^\circ$ $= 617.07 \text{ cm}^2$ (d) $\angle PED = \angle EDC = 180^\circ - 120^\circ - 43.49^\circ$ $= 16.51^\circ$ $\cos 16.51^\circ = \frac{DC}{37.75 \text{ cm}}$ $DC = 37.75 \cos 16.51^\circ$ $DC = 36.19 \text{ cm}$ $\text{Luas / Area} = \frac{1}{2}(36.19)(37.75)\sin 16.51^\circ$ $= 194.12 \text{ cm}^2$	1 1 1 1 1 1 1 1 1	10
14	(a) $v = mt^2 + kt$ $a = \frac{dv}{dt}$ $\frac{dv}{dt} = 2mt + k$	1	

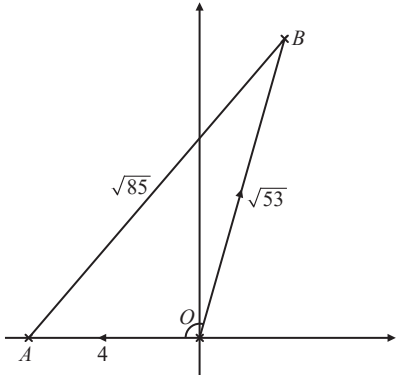
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	Apabila / When $t = 2$ s, $a = -4$ m s⁻²; $a = 2mt + k$ $-4 = 2m(2) + k$ $-4 = 4m + k$ $-4 - 4m = k$ ① Berhenti seketika / Stops instantaneously $\rightarrow v = 0$, $t = 5$ s; $v = mt^2 + kt$ $0 = m(5)^2 + k(5)$ $0 = 25m + 5k$ ② Ganti ① dalam ② / Substitute ① into ② ; $25m + 5(-4 - 4m) = 0$ $25m - 20 - 20m = 0$ $5m = 20$ $m = 4$ Dari / From ① ; $k = -4 - 4(4)$ $k = -4 - 16$ $k = -20$ $\therefore v = 4t^2 - 20t$ (b) Kiri / Left : $v < 0$ $4t^2 - 20t < 0$ $4t(t - 5) < 0$  $0 < t < 5$ (c) $s = \int_2^3 (4t^2 - 20t) dt$ $= \left[\frac{4}{3}t^3 - 10t^2 \right]_2^3$ $= \left[\frac{4}{3}(3)^3 - 10(3)^2 \right] - \left[\frac{4}{3}(2)^3 - 10(2)^2 \right]$ $= -54 - \left(-\frac{88}{3} \right)$ $= -\frac{74}{3} \text{ m} = -24\frac{2}{3} \text{ m}$	1 1 1 1 1 1 1 1 1 1 1 1	10
15	(a) I $x + y \leq 30$ II $y \leq x + 10$ III $4x + 8y \geq 120$	1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b)  (c) (i) Apabila / When $x = 12$, $9 \leq y \leq 18$ (ii) Perbelanjaan / Expenses: $4x + 8y = 32$ Titik optimum ialah / The optimal point is (10, 20) Jumlah perbelanjaan / Total expenses $= \text{RM}4(10) + \text{RM}8(20)$ $= \text{RM}200$	3 2 1 1	10

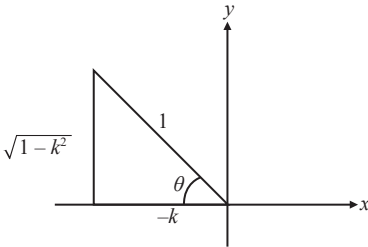
KERTAS 1

Bahagian A

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
1	(a) Tidak tertakrif apabila / <i>Not defined when</i>: $2x + 1 = 0$ $x = -\frac{1}{2}$ $\therefore p = -\frac{1}{2}$ (b) (i) (ii) $A(2, 1)$	1 2 1	4
2	(a) $3x^2 + kx - 12 = 0$ $3\left(\frac{4}{3}\right)^2 + k\left(\frac{4}{3}\right) - 12 = 0$ $\frac{16}{3} + \frac{4}{3}k - 12 = 0$ $\frac{4}{3}k = \frac{20}{3}$ $k = \frac{20}{3} \times \frac{3}{4}$ $k = 5$ (b) $ax^2 + bx + c = 0$ $ax^2 + bx = -c$ $x^2 + \frac{b}{a}x = -\frac{c}{a}$ $x^2 + \frac{b}{a}x + \left(\frac{b}{2a}\right)^2 = -\frac{c}{a} + \left(\frac{b}{2a}\right)^2$ $\left(x + \frac{b}{2a}\right)^2 = -\frac{c}{a} + \frac{b^2}{4a^2}$ $\left(x + \frac{b}{2a}\right)^2 = -\frac{4ac}{4a^2} + \frac{b^2}{4a^2}$	1 1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
5	 $\vec{OA} = -4\hat{i}$ $\vec{OB} = 2\hat{i} + 7\hat{j}$ $\vec{OA} = \sqrt{(-4)^2} = 4$ $\vec{OB} = \sqrt{(2)^2 + (7)^2} = \sqrt{53}$ $\vec{AB} = \vec{AO} + \vec{OB}$ $= 4\hat{i} + 2\hat{i} + 7\hat{j}$ $= 6\hat{i} + 7\hat{j}$ $\vec{AB} = \sqrt{(6)^2 + (7)^2} = \sqrt{85}$ Menggunakan Petua kosinus / Using the cosine rule: $(OA)^2 + (OB)^2 - 2(OA)(OB) \cos / \cos \angle BOA = AB^2$ $4^2 + (\sqrt{53})^2 - 2(4)(\sqrt{53}) \cos / \cos \angle BOA = (\sqrt{85})^2$ $16 + 53 - 58.2409 \cos / \cos \angle BOA = 85$ $\cos / \cos \angle BOA = \frac{85 - 69}{-58.2409}$ $\angle BOA = \cos^{-1} / \cos^{-1}(-0.2747)$ $= 105.94^\circ$	1 1 1 4	4
6	(a) $\left(\frac{y}{x} = (5-p)x + \frac{4}{x^2}\right) \dots \dots \times x^2$ $xy = (5-p)x^3 + 4$ $Y = mX + C$ (b) $C = \frac{3}{2}k = 4$ $\frac{3k}{2} = 4$ $3k = 8$ $k = \frac{8}{3}$ $\frac{4 - (-5)}{0 - 3} = 5 - p$ $\frac{9}{-3} = 5 - p$	1 1 1	

[illegible]

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
11	(a) $p = \frac{5}{12}, q = \frac{7}{12}, n = 7$ $p(X=5) = {}^7C_5 \left(\frac{5}{12}\right)^5 \left(\frac{7}{12}\right)^2$ $= 0.08974$ (b) (i) $1.5 = \frac{X-165}{\sqrt{400}}$ $30 = X-165$ $X = 195$ (ii) $P(X < k) = 0.5987$ $1 - P(X > k) = 0.5987$ $P\left(Z > \frac{k-165}{\sqrt{400}}\right) = 0.4013$ $\frac{k-165}{20} = 0.25$ $k-165 = 5$ $k = 170$ 0.25 ialah nilai z dalam sifir taburan normal piawai 0.25 is the z-score obtained from the standard normal distribution table	1 1 1 1 1 1 1	7
12	(a)  (i) $\tan \theta = \frac{\sqrt{1-k^2}}{-k}$ $\cot \theta = \frac{1}{\tan \theta}$ $\cot \theta = -\frac{k}{\sqrt{1-k^2}}$ (ii) $\cos 2\theta = \cos^2 \theta - \sin^2 \theta$ $\cos 2\theta = (-k)^2 - \left(\frac{\sqrt{1-k^2}}{1}\right)^2$ $= k^2 - (1-k^2)$ $= k^2 - 1 + k^2$ $= 2k^2 - 1$ (b) $p = -3$ $y = 3 \sin \frac{5}{2}x \rightarrow \frac{5}{2}$ kitaran / cycles $1 \text{ kitaran / cycles} : 360^\circ \div \frac{5}{2} = 144^\circ$ $\frac{3}{4} \text{ kitaran / cycles} : 144^\circ \times \frac{3}{4} = 108^\circ$ $\therefore m = 108^\circ$	1 1 1 1 1 1	7

Bahagian B

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
13	(a) Katakan / Let $3x - 1 = y$ $3x = y + 1$ $x = \frac{y + 1}{3}$ $\therefore f^{-1}(x) = \frac{x + 1}{3}$	1	8
	(b) $f^{-1}g(x) = mx + 5$ $f^{-1}(2x - h) = mx + 5$ $\frac{(2x - h) + 1}{3} = mx + 5$ $\frac{2x - h + 1}{3} = mx + 5$	1	
	$mx = \frac{2}{3}x$		
	$m = \frac{2}{3}$		
	$\frac{-h + 1}{3} = 5$		
	$-h + 1 = 15$	1	
	$-h = 14$		
	$h = -14$	1	
	(c) $pg(x) = 5x$ $p[g(x)] = 5x$ $p(2x + 14) = 5x$	1	
	Katakan / Let $2x + 14 = k$ $2x = k - 14$ $x = \frac{k - 14}{2}$		
14	$p(k) = 5\left(\frac{k - 14}{2}\right)$ $= \frac{5k - 70}{2}$ $= \frac{5}{2}k - 35$ $\therefore p(x) = \frac{5}{2}x - 35$	1	
	(a) $\angle COB = 2 \times 43^\circ$ $= 86^\circ$ $= 86^\circ \times \frac{3.142}{180^\circ}$ $= 1.501 \text{ rad}$	1	
	$s_{BC} = r\theta$	1	
	$s_{BC} = (9 \text{ cm})(1.501 \text{ rad})$ $= 13.509 \text{ cm}$	1	
	(b) $BC^2 = 9^2 + 9^2 - 2(9)(9) \cos 86^\circ$ $BC = \sqrt{150.6995}$ $= 12.28 \text{ cm}$	1	

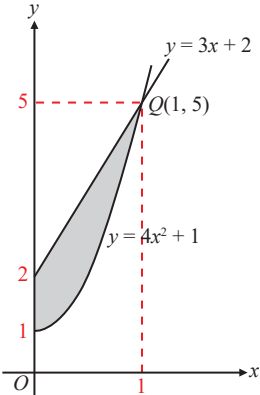
Bahagian A

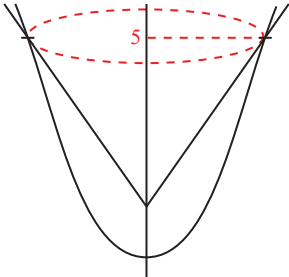
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
1	$x = \text{payung}/\text{umbrella}$; $y = \text{topi}/\text{cap}$; $z = \text{T-shirt}$ $x + 2y + z = 75$ ① $2x + y + z = 79$ ② $x + y + 2z = 82$ ③ ② — ③; $x - z = -3$ ④ ② $\times 2 -$ ①; $3x + z = 83$ $z = 83 - 3x$ ⑤ Gantikan ⑤ dalam ④ / <i>Substitute ⑤ into ④</i> ; $x - (83 - 3x) = -3$ $x - 83 + 3x = -3$ $4x = 80$ $x = 20$ Dari / <i>From</i> ⑤; $z = 83 - 3(20)$ $z = 83 - 60$ $z = 23$ Dari / <i>From</i> ③; $20 + y + 2(23) = 82$ $20 + y + 46 = 82$ $y = 16$ $\therefore$ Baju – T / <i>T-shirt</i> = RM23, Payung / <i>Umbrella</i> = RM20, Topi / <i>Cap</i> = RM16	 1 1 1 1 1 1	6
2	(a) $f(0) = (0)^2 + p(0) - 5$ $f(0) = -5$ $\therefore H(0, -5)$ (b) $f(x) = x^2 + px + \left(\frac{p}{2}\right)^2 - \left(\frac{p}{2}\right)^2 - 5$ $f(x) = \left(x + \frac{p}{2}\right)^2 - \frac{p^2}{4} - 5$ $x + \frac{p}{2} = 0$ $x = -\frac{p}{2}$ $2 = -\frac{p}{2}$ $p = -4$ $m = -\frac{p^2}{4} - 5$ $m = -\frac{(-4)^2}{4} - 5$ $m = -9$	 1 1 1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(c) $f(x) = (x - 2)^2 - 9$ Bergerak 3 unit ke kanan / Moves 3 units to the right $f(x) = (x - 2 - 3)^2 - 9$ $f(x) = (x - 5)^2 - 9$	1	6
3	(a) $a = \text{RM}12\,000$; $r = 100\% + 8\% = 1.08$ $S_n = \frac{a(r^n - 1)}{r - 1}$, $r \neq 1$ $S_8 = \frac{12\,000(1.08^8 - 1)}{1.08 - 1}$ $S_8 = \text{RM}12\,7639.53$ (b) $T_n > 80\,000$ $T_n = ar^{n-1}$ $12000(1.08)^{n-1} > 80\,000$ $(1.08)^{n-1} > 6.6667$ $(n - 1)\log_{10} 1.08 > \log_{10} 6.6667$ $n - 1 > \frac{\log_{10} 6.6667}{\log_{10} 1.08}$ $n - 1 > 24.65$ $n > 25.65$ $n = 26$ $\therefore$ Encik Brian akan mula memperoleh keuntungan melebihi RM80 ribu pada tahun 2034 <i>Mr. Brian will start obtaining a net profit exceeding RM80 thousand in the year 2034</i>	1 1 1 1 1 1 1	7
4	(a) Di titik pusing / At turning point $(-1, 5) \rightarrow \frac{dy}{dx} = 0$ $p(-1)^2 + 3(-1) = 0$ $p - 3 = 0$ $p = 3$ (b) $\frac{dy}{dx} = 3x^2 + 3x$ $\frac{d^2y}{dx^2} = 6x + 3$ pada / at $(-1, 5)$ $= 6(-1) + 3$ $= -6 + 3$ $= -3 < 0$ $\therefore \frac{d^2y}{dx^2} < 0$ $\therefore (-1, 5)$ adalah maksimum / $(-1, 5)$ is a maximum (c) $y = \int (3x^2 + 3x) dx$ $y = \frac{3x^3}{3} + \frac{3x^2}{2} + c$ pada / at $(-1, 5)$ $5 = \frac{3(-1)^3}{3} + \frac{3(-1)^2}{2} + c$ $5 = -1 + \frac{3}{2} + c$ $c = \frac{9}{2}$	1 1 1 1 1 1 1	

Bahagian B

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks														
8	(a) <table><tr><td>$\log_{10}(x + 1)$</td><td>0.30</td><td>0.48</td><td>0.60</td><td>0.70</td><td>0.78</td><td>0.85</td></tr><tr><td>$\log_{10}y$</td><td>0.42</td><td>0.84</td><td>1.14</td><td>1.38</td><td>1.57</td><td>1.73</td></tr></table> (b) (i) Apabila / When $x = 3.5 \rightarrow \log_{10}(x + 1) = 0.65$ Dari graf / From the graph $\log_{10}(x + 1) = 0.65 ; \log_{10} y = 1.25$ $y = 10^{1.25}$ $y = 17.78$	$\log_{10}(x + 1)$	0.30	0.48	0.60	0.70	0.78	0.85	$\log_{10}y$	0.42	0.84	1.14	1.38	1.57	1.73	1 3 1 1	
$\log_{10}(x + 1)$	0.30	0.48	0.60	0.70	0.78	0.85											
$\log_{10}y$	0.42	0.84	1.14	1.38	1.57	1.73											

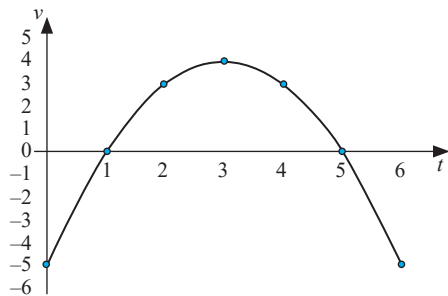
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	$s_{AB \text{ minor}} = (8 \text{ cm})(2.306 \text{ rad})$ $= 18.448 \text{ cm}$ Perimeter $= 14.62 \text{ cm} + 18.448 \text{ cm}$ $= 33.068 \text{ cm}$ (c) Luas AOB_{minor} / Area of $AOB_{\text{minor}} = \frac{1}{2}(8)^2(2.306)$ $= 73.792 \text{ cm}^2$ Luas $AOBC$ / Area of $AOBC = 2 \times \Delta OAC$ $= 2 \times \left(\frac{1}{2} \times 18 \times 8\right)$ $= 144 \text{ cm}^2$ Luas lorekan / Area of shaded $= 144 \text{ cm}^2 - 73.792 \text{ cm}^2$ $= 70.208 \text{ cm}^2$	1 1 1 1 1 1	10
10	(a) Kecerunan tangen pada lengkung $y = 4x^2 + 1$ Gradient of tangent to the curve $y = 4x^2 + 1$ $m_1 = \frac{dy}{dx} = 8x$ $= 8(1)$; pada titik / at point $Q(1, 5)$ $= 8$ Kecerunan normal / Gradient of normal $\rightarrow m_1 m_2 = -1$ $(8)(m_2) = -1$ $m_2 = -\frac{1}{8}$ Persamaan normal di $Q(1, 5)$ / Equation of normal at $Q(1, 5)$ $y - 5 = -\frac{1}{8}(x - 1)$ $y = -\frac{1}{8}x + \frac{1}{8} + 5$ $y = -\frac{1}{8}x + \frac{41}{8}$ (b) 	1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	Luas / Area = $\int_0^1 (3x + 2) dx - \int_0^1 (4x^2 + 1) dx$ $= \left[\frac{3x^2}{2} + 2x \right]_0^1 - \left[\frac{4x^3}{3} + x \right]_0^1$ $= \left\{ \left[\frac{3(1)^2}{2} + 2(1) \right] - \left[\frac{3(0)^2}{2} + 2(0) \right] \right\} -$ $\left\{ \left[\frac{4(1)^3}{3} + (1) \right] - \left[\frac{4(0)^3}{3} + (0) \right] \right\}$ $= \left(\frac{7}{2} - 0 \right) - \left(\frac{7}{3} - 0 \right)$ $= \frac{7}{6} \text{ unit}^2$ (c)  $y = 4x^2 + 1$ $y - 1 = 4x^2$ $\frac{y - 1}{4} = x^2$ Isipadu / Volume = $\pi \int_1^5 x^2 dy$ $= \pi \int_1^5 \left(\frac{y}{4} - \frac{1}{4} \right) dy$ $= \pi \left[\frac{1}{8} y^2 - \frac{1}{4} y \right]_1^5$ $= \pi \left[\frac{1}{8} (5)^2 - \frac{1}{4} (5) \right] - \pi \left[\frac{1}{8} (1)^2 - \frac{1}{4} (1) \right]$ $= \frac{15}{8} \pi - \left(-\frac{1}{8} \pi \right)$ $= 2\pi \text{ unit}^3$	1 1 1 1 1 1 1 1	10
11	(a) (i) $\overrightarrow{MQ} = \overrightarrow{MN} + \overrightarrow{NQ}$ $= -4\vec{x} + \frac{3}{4}\overrightarrow{NO}$ $= -4\vec{x} + \frac{3}{4}(-8\vec{y})$ $= -4\vec{x} - 6\vec{y}$	1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(ii) $\overrightarrow{NP} = \overrightarrow{NM} + \overrightarrow{MP}$ $= 4\tilde{x} + \frac{2}{3}\overrightarrow{MO}$ $= 4\tilde{x} + \frac{2}{3}(\overrightarrow{MN} + \overrightarrow{NO})$ $= 4\tilde{x} + \frac{2}{3}(-4\tilde{x} - 8\tilde{y})$ $= 4\tilde{x} - \frac{8}{3}\tilde{x} - \frac{16}{3}\tilde{y}$ $= \frac{4}{3}\tilde{x} - \frac{16}{3}\tilde{y}$	1	
	(b) $\overrightarrow{MR} = k\overrightarrow{MQ}$ $\overrightarrow{MR} = k(-4\tilde{x} - 6\tilde{y})$	1	
	$\overrightarrow{NR} = h\overrightarrow{NP}$ $= h\left(\frac{4}{3}\tilde{x} - \frac{16}{3}\tilde{y}\right)$		
	$\overrightarrow{MR} = \overrightarrow{MN} + \overrightarrow{NR}$ $= -4\tilde{x} + h\left(\frac{4}{3}\tilde{x} - \frac{16h}{3}\tilde{y}\right)$ $= \left(\frac{4h}{3} - 4\right)\tilde{x} - \frac{16}{3}\tilde{y}$	1	
	$\tilde{x} : \frac{4h}{3} - 4 = -4k$ $4h = -12k + 12 \dots\dots\dots \textcircled{1}$	1	
	$\tilde{y} : -6k = -\frac{16h}{3}$ $k = \frac{8h}{9} \dots\dots\dots \textcircled{2}$		
	Gantikan $\textcircled{2}$ dalam $\textcircled{1}$ / Substitute $\textcircled{2}$ into $\textcircled{1}$ $4h = -12\left(\frac{8h}{9}\right) + 12$ $4h = -\frac{32h}{3} + 12$ $\frac{44}{3}h = 12$ $h = \frac{9}{11}$	1	
	$k = \frac{8}{9}\left(\frac{9}{11}\right)$	1	
	$k = \frac{8}{11}$	1	
		1	10

Bahagian C

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
12	(a) $\frac{8.50}{p} \times 100 = 150$ $p = 5.67$	1	10
	$\frac{q}{5.93} \times 100 = 125$ $q = 7.41$	1	
	$r = \frac{6.05}{5.50} \times 100$ $r = 110$	1	
	(b) $I_{2023/2020} = 140$		
	$\frac{(150)(3) + (146)(s) + (125)(2) + (110)(1)}{3 + s + 2 + 1} = 140$	1	
	$810 + 146s = 140s + 840$ $6s = 30$ $s = 5$	1	
	(c) $\frac{P_{2023}}{1\,500} \times 100 = 140$	1	
	$P_{2023} = \frac{140 \times 1500}{100}$ $P_{2023} = \text{RM2 } 100$	1	
	(d) $I_{2024/2020} = 190$		
	$I_{2024/2023} = \frac{I_{2024}}{I_{2020}} \times \frac{I_{2020}}{I_{2023}} \times 100$ $I_{2024/2023} = \frac{190}{100} \times \frac{100}{25} \times 100$ $I_{2024/2023} = 152$	1 1	
13	(a) $\frac{\sin \angle RQS}{110} = \frac{\sin 40^\circ}{75}$ $\angle RQS = \sin^{-1}(0.9428)$ $\angle RQS = 70.53^\circ$	1	
	$\angle QRS = 180^\circ - 70.53^\circ - 40^\circ$ $= 69.47^\circ$	1	
	$SQ^2 = (75)^2 + (110)^2 - 2(75)(110) \cos 69.47^\circ$	1	
	$SQ = \sqrt{11\,938.49}$ $SQ = 109.26 \text{ m}$	1	
	Jumlah pagar yang diperlukan / Total fence needed:	1	
	Perimeter = $80 \text{ m} + 60 \text{ m} + 75 \text{ m} + 110 \text{ m} + 109.26 \text{ m}$ $= 434.26 \text{ m}$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks															
	(b) $\frac{\sin \angle SPQ}{109.26} = \frac{\sin 40^\circ}{80}$ $\angle SPQ = \sin^{-1}(0.8779)$ $\angle SPQ = 61.39^\circ$ $\text{Luas / Area} = \frac{1}{2}(80)(60) \sin 61.39^\circ$ $= 2\,106.96 \text{ m}^2$	1 1 1 1	10															
14	(a) Halaju minimum / <i>Minimum velocity</i> $\rightarrow a = 0$ $6 - 2t = 0$ $t = 3$ $v = \int (6 - 2t) dt$ $v = 6t - t^2 + c$; apabila / <i>when</i> $t = 0 \text{ s}$, $v = -5 \text{ m s}^{-1}$ $-5 = 6(0) - (0)^2 + c$ $c = -5$ $\therefore v = 6t - t^2 - 5$ Apabila / <i>When</i> $t = 3$; $v = 6(3) - (3)^2 - 5$ $v = 4 \text{ m s}^{-1}$ (b) <table border="1"><tr><td>t</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>v</td><td>-5</td><td>0</td><td>3</td><td>4</td><td>3</td><td>0</td><td>-5</td></tr></table>  (c) $s = \left \int_0^1 (6t - t^2 - 5) dt \right + \left \int_1^5 (6t - t^2 - 5) dt \right + \left \int_5^6 (6t - t^2 - 5) dt \right $ $= \left \left[3t^2 - \frac{t^3}{3} - 5t \right]_0^1 \right + \left \left[3t^2 - \frac{t^3}{3} - 5t \right]_1^5 \right + \left \left[3t^2 - \frac{t^3}{3} - 5t \right]_5^6 \right $ $= \left\{ \left[3(1)^2 - \frac{(1)^3}{3} - 5(1) \right] - \left[3(0)^2 - \frac{(0)^3}{3} - 5(0) \right] \right\} +$ $\left\{ \left[3(5)^2 - \frac{(5)^3}{3} - 5(5) \right] - \left[3(1)^2 - \frac{(1)^3}{3} - 5(1) \right] \right\} +$ $\left\{ \left[3(6)^2 - \frac{(6)^3}{3} - 5(6) \right] - \left[3(5)^2 - \frac{(5)^3}{3} - 5(5) \right] \right\}$ $= \left -2\frac{1}{3} - 0 \right + \left 8\frac{1}{3} - \left(-2\frac{1}{3}\right) \right + \left 6 - 8\frac{1}{3} \right $ $= 2\frac{1}{3} + 10\frac{2}{3} + 2\frac{1}{3}$ $= 15\frac{1}{3} \text{ m}$	t	0	1	2	3	4	5	6	v	-5	0	3	4	3	0	-5	1 <
t	0	1	2	3	4	5	6											
v	-5	0	3	4	3	0	-5											

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
15	(a) I $x + y \leq 350$	1	
	II $x \geq y + 100$ $y \leq x - 100$	1	
	III $x \geq \frac{1}{2}y$ $y \leq 2x$	1	
	(b)	4	
(c)	(i) Apabila, $x = 180$ julat nilai y ialah $80 \leq y \leq 170$ Maka, bilangan maksimum kek cawan strawberi yang dihasilkan ialah 170 biji. <i>When $x = 130$, the range of y values is $80 \leq y \leq 170$ Hence, the maximum number of strawberry cupcakes produced is 170 pieces.</i>	1	10
	(ii) Keuntungan / Profit = $1.50x + 2.50y$ Titik optimum ialah / The optimal point is (225, 125) Keuntungan maksimum / Maximum profit = RM1.50(225) + RM2.50(125) = RM650	1	
		1	