

KERTAS SOALAN PEPERIKSAAN SEBENAR SPM 2021-2023



MATEMATIK TAMBAHAN

Dwibahasa

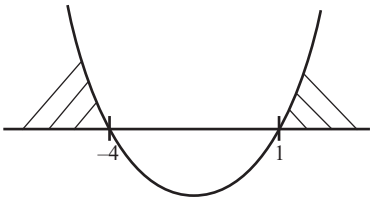
SIJIL PELAJARAN MALAYSIA 2021

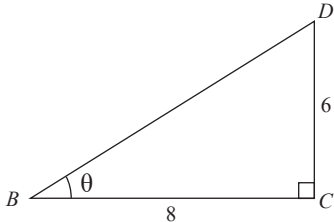
KERTAS 1

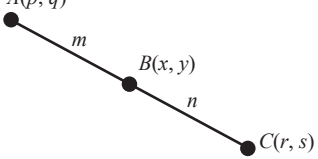
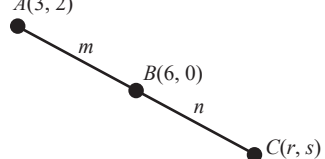
Bahagian A

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
1	$\angle AOB \text{ major} = 2\pi - \frac{\pi}{3}$ $= \frac{5}{3}\pi$ $\text{Luas / Area} = \frac{1}{2}(2)^2 \left(\frac{5}{3}\pi\right)$ $= \frac{10}{3}\pi \text{ cm}^2$	 1 1	2
2	$m = \frac{7-1}{5-2} = 2$ $\frac{c-1}{0-2} = 2$ $c-1 = -4$ $c = -3$ $\ln y = 2 \ln x - 3$ $\ln y - \ln x^2 = -3$ $\ln\left(\frac{y}{x^2}\right) = -3$ $\frac{y}{x^2} = e^{-3}$ $y = \frac{x^2}{e^3}$	 1 1 1	4

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
3	(a) $S_n < 650$ $217 \left[\frac{1 - \left(\frac{2}{3}\right)^n}{1 - \frac{2}{3}} \right] < 650$ $1 - \left(\frac{2}{3}\right)^n < \frac{650}{651}$ $1 - \frac{650}{651} < \left(\frac{2}{3}\right)^n$ $\frac{1}{651} < \left(\frac{2}{3}\right)^n$ $\left(\frac{2}{3}\right)^n > \frac{1}{651}$ $n < \frac{\lg\left(\frac{1}{651}\right)}{\lg\left(\frac{2}{3}\right)}$ $n < 15.97$ $n = 15$	1	5
	(b) $S_\infty - T_5 = \frac{217}{1 - \frac{2}{3}} - 217\left(\frac{2}{3}\right)^4$ $= 651 - \frac{3\,472}{81}$ $= 608\frac{11}{81}$	2	
		1	
4	(a) $\frac{dy}{dx} = 1 - \frac{4}{x^3}$	1	4
	(b) $y = -2x$ $m_1 = -2$ $m_2 = \frac{1}{2}$ $1 - \frac{4}{x^3} = \frac{1}{2}$ $\frac{1}{2} = \frac{4}{x^3}$ $x = 2$ Gantikan $x = 2$ ke dalam Substitute $x = 2$ into $y = x + \frac{2}{x^2}$ $= 2 + \frac{2}{x^2}$ $= 2 + \frac{2}{4}$ $= \frac{5}{2}$ $P\left(2, \frac{5}{2}\right)$	1	
		1	

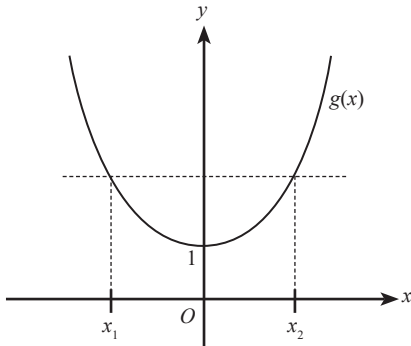
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
5	(a) $f(x) > 0$ $x^2 + 3x - 4 > 0$ $(x + 4)(x - 1) > 0$ 	1	
	$x < -4, x > 1$	1	
	(b) (i) $px + q - (x^2 + 3x - 4) = 0$	1	
	$-x^2 + (p - 3)x + q + 4 = 0$	1	
	$x^2 - (p - 3)x - q - 4 = 0$		
	$\alpha + \beta = p - 3$		
	$\alpha\beta = -q - 4$		
	(ii) $x^2 + rx + r - 10 = 0$		
	$\frac{2}{\alpha} + \frac{2}{\beta} = -r$ dan / and $\left(\frac{2}{\alpha}\right)\left(\frac{2}{\beta}\right) = r - 10$ $\frac{2}{\alpha} + \frac{2}{\beta} = -r$ $2\left(\frac{\beta + \alpha}{\alpha\beta}\right) = -r$ $\frac{2(p - 3)}{-q - 4} = -r$ $r = \frac{2(p - 3)}{q + 4}$	1	
	$\left(\frac{2}{\alpha}\right)\left(\frac{2}{\beta}\right) = r - 10$ $\frac{4}{\alpha\beta} = r - 10$ $\frac{4}{-q - 4} = r - 10$ $r = \frac{-4}{q + 4} + 10$	1	
	$\frac{2(p - 3)}{q + 4} = \frac{-4}{q + 4} + 10$ $2(p - 3) = -4 + 10(q + 4)$ $2(p - 3) = 10q + 36$ $p - 3 = 5q + 18$ $p = 5q + 21$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
6	(a) 		
	$\tan \theta = \frac{6}{8}$	1	
	$\theta = \tan^{-1} \left(\frac{6}{8} \right)$		
	$= 0.6436 \text{ radian}$	1	
	(b) $BD = \sqrt{6^2 + 8^2} = 10 \text{ cm}$ $\angle ABH = \frac{\pi}{3} \text{ rad}$ $\angle HBD = \pi - \frac{\pi}{3} - 0.6436 = 1.451 \text{ rad}$ $\angle GAH = \frac{\pi}{2} - \frac{\pi}{3} = \frac{\pi}{6} \text{ rad}$ $EF = \sqrt{12^2 + 18^2} = 21.63 \text{ cm}$ $S_{GH} = 10 \left(\frac{\pi}{6} \right) = \frac{5\pi}{3} \text{ cm}$ atau / or $S_{HD} = 10(1.451) = 14.51$ Perimeter $= 10 + \frac{5\pi}{3} + 14.51 + 2 + 21.63$ $= 53.38 \text{ cm}$	1 1 1 1 1 1 1	
7	(a) $ \vec{ED} + \vec{DB} + \vec{BE} = 0$	1	
	(b) $\vec{EC} = 11\vec{i} + 4\vec{j} + 10\vec{k}$ $= 15\vec{i} + 10\vec{k}$	1 1	
	(c) $\begin{pmatrix} 1 \\ 1 \end{pmatrix} + \begin{pmatrix} 3 \\ 4 \end{pmatrix} t = \begin{pmatrix} 5 \\ p \end{pmatrix}$ $1 + 3t = 5$ $t = \frac{4}{3}$ $1 + 4t = p$ $1 + 4 \left(\frac{4}{3} \right) = p$ $\frac{3 + 16}{3} = p$ $p = \frac{19}{3}$	1 1 1 1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
8	(a)  $\frac{q - y}{y - s} = \frac{m}{n}$ $nq - ny = my - ms$ $ms + nq = (m + n)y$ $y = \frac{ms + nq}{m + n}$ $\frac{x - p}{r - x} = \frac{m}{n}$ $nx - np = mr - mx$ $(m + n)x = mr + np$ $x = \frac{mr + np}{m + n}$ $(x, y) = \left(\frac{mr + np}{m + n}, \frac{ms + nq}{m + n} \right)$	1	
	(b) (i)  $\frac{m}{n} = \frac{6 - 3}{r - 6}$ $\frac{m}{n} = \frac{3}{r - 6}$ $m \leq n$ $r - 6 \geq 3$ $r \geq 9$ $\frac{m}{n} = \frac{2 - 0}{0 - s}$ $\frac{m}{n} = \frac{2}{-s}$ $m \leq n$ $2 \leq -s$ $s \leq -2$	1	
	(ii) $m_{AB} = \frac{2 - 0}{3 - 6} = -\frac{2}{3}$ $m = -\frac{p}{6}$ $-\frac{p}{6} = -\frac{2}{3}$ $p = 4$	1	
		1	
			6

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
9	(a) $g(x) = -3x^2 + 8x - 4$	1	5
	(b) Kawasan berlorek / Shaded area $= \int_1^2 (x^3 - 6x^2 + 12x - 6) dx - [-x^3 + 4x^2 - 4x]_1^2$ $= \left[\frac{x^4}{4} - \frac{6x^3}{3} + \frac{12x^2}{2} - 6x + x^3 - 4x^2 + 4x \right]_1^2$ $= \left[\frac{x^4}{4} - x^3 + 2x^2 - 2x \right]_1^2$ $= \left[\frac{2^4}{4} - 2^3 + 2(2)^2 - 2(2) \right] - \left[\frac{1}{4} - 1^3 + 2(1)^2 - 2(1) \right]$ $= \left(\frac{16}{4} - 8 + 8 - 4 \right) - \left(\frac{1}{4} - 1 + 2 - 2 \right)$ $= 0 - \left(-\frac{3}{4} \right)$ $= \frac{3}{4} \text{ unit}^2$	2 1 1	
10	(a) $(x, x + 20, x + 40)$ mm	1	
	(b) $a = x$ $T_{72} = x + (72 - 1)(20)$ $= x + 1\,420$ $S_{72} = 55\,440$		
	$\frac{72}{2} (x + x + 1\,420) = 55\,440$ $2x + 1\,420 = \frac{55\,440}{36}$ $x = 60$	1 1	
	18 kepingan terakhir / Last 18 terms: $T_{55}, T_{56}, \dots, T_{72}$ $S_{18} = \frac{18}{2} [2(60 + 30(20)) + (18 - 1)(20)]$ $= 14\,940 \text{ mm}$	1 1	
	(c) Cara 1 / Method 1 $60 + (72 - 1)(20) = 1\,480$ 500 1 480 $2\pi r = 1\,480$ $r = \frac{1\,480}{2}$ $= \frac{740}{\pi}$ $60 + (72 - 1)(20) = 1\,480 \text{ dan / and } r = \frac{740}{\pi}$		
		1	

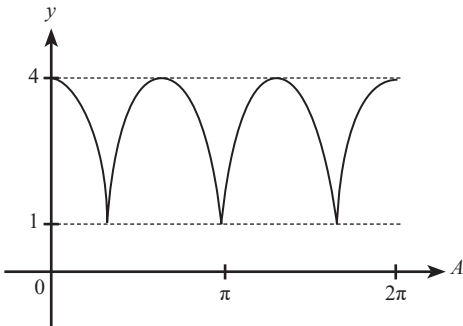
Bahagian B

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
13	(a) $\frac{3}{4x-1} = \frac{1}{3}$ $x = \frac{5}{2}$	1 1	8
	(b) $f(m+1) = 3fg(p)$ $\frac{3}{4(m+1)-1} = 3\left(\frac{3}{4p^2+3}\right)$ $3(4m+4-1) = 4p^2+3$ $12m+9 = 4p^2+3$ $m = \frac{4p^2-6}{12}$ $m = \frac{2p^2-3}{6}$	1 1	
	(c) (i) $\frac{3}{4g(x)-1} = \frac{3}{4x^2+3}$ $4g(x)-1 = 4x^2+3$ $g(x) = x^2+1$	1 1	
	(ii) Ujian garis mengufuk Horizontal line test 	1	
	Bukan hubungan satu kepada satu Not one to one relationship	1	
14	(a) $(2^{x+1})^2 + (\sqrt{2^x})^2 = (3\sqrt{2})^2$ $4(2^{2x}) + 2^x = 18$ $4(2^{2x}) + 2^x - 18 = 0$ $[4(2^x) + 9][2^x - 2] = 0$ $4(2^x) + 9 = 0$ $2^x = -\frac{9}{4}$ $2^x > 0$ $2^x = -\frac{9}{4}$ (tidak mungkin / not possible) $2^x - 2 = 0$ $2^x = 2$ $x = 1$	1 1 1 1 1 1	

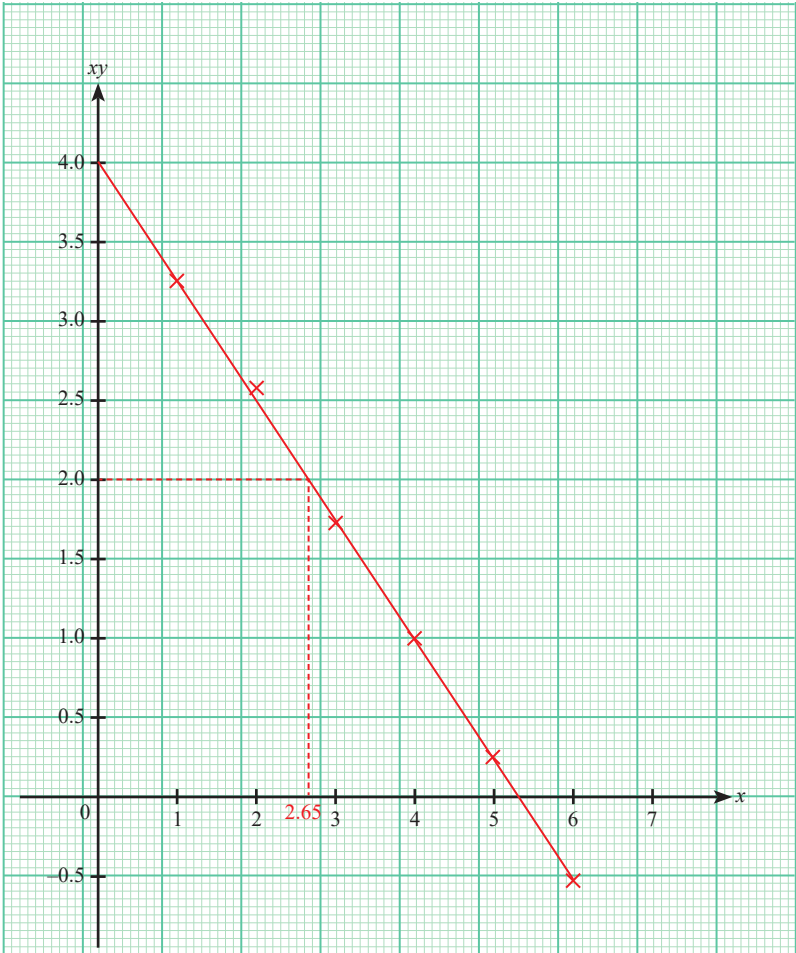
Bahagian A

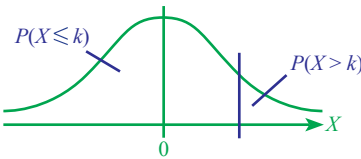
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
1	$4x + y + 2z = 0 \dots\dots\dots ①$ $-2x + 3y + z = 8 \dots\dots\dots ②$ $x - y - z = -\frac{1}{2} \dots\dots\dots ③$ Dari / Form ① : $y = -4x - 2z \dots\dots\dots ④$ Ganti ④ ke dalam ② <i>Substitute ④ into ②</i> $-2x + 3(-4x - 2z) + z = 8$ $-2x - 12x - 6z + z = 8$ $-14x - 5z = 8$ $x = \frac{-5z - 8}{14} \dots\dots\dots ⑤$ Ganti ④ dan ⑤ ke dalam ③ <i>Substitute ④ and ⑤ into ③</i> $\left(\frac{-5z - 8}{14}\right) - \left[4\left(\frac{-5z - 8}{14}\right) - 2z\right] - z = -\frac{1}{2}$ $-5z - 8 - 20z - 32 + 28z - 14z = -7$ $-11z = 33$ $z = -3$ $x = \frac{-5(-3) - 8}{14} = \frac{1}{2}$ $y = -4\left(\frac{1}{2}\right) - 2(-3) = 4$ $x = \frac{1}{2}; y = 4; z = -3$	1 1 1 1 1 1 1	5
2	(a) $\sqrt{0.25}$ bukan suatu surd kerana ia merupakan nombor nisbah. <i>$\sqrt{0.25}$ is not a surd because it is a rational number.</i> (b) (i) $\log_a b = x$ $b = a^x$ $\log_c b = \log_c a^x$ $\log_c b = x \log_c a$ $x = \frac{\log_c b}{\log_c a}$ $\log_a b = \frac{\log_c b}{\log_c a}$ (ii) $\log_3 h + \log_9 k = \log_3 h + \frac{\log_3 k}{\log_3 9}$ $= \log_3 h + \frac{\log_3 k}{\log_3 3^2}$ $= \log_3 h + \frac{\log_3 k}{2}$ $= \log_3 h + \frac{1}{2} \log_3 k$ $= \log_3 h + \log_3 k^{\frac{1}{2}}$ $= \log_3 hk^{\frac{1}{2}}$	1 1 1 1 1 1 1 1	7

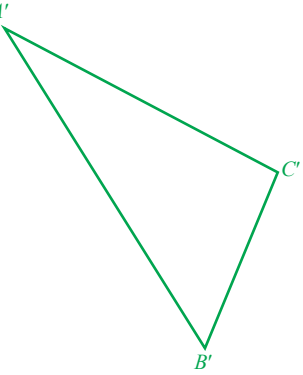
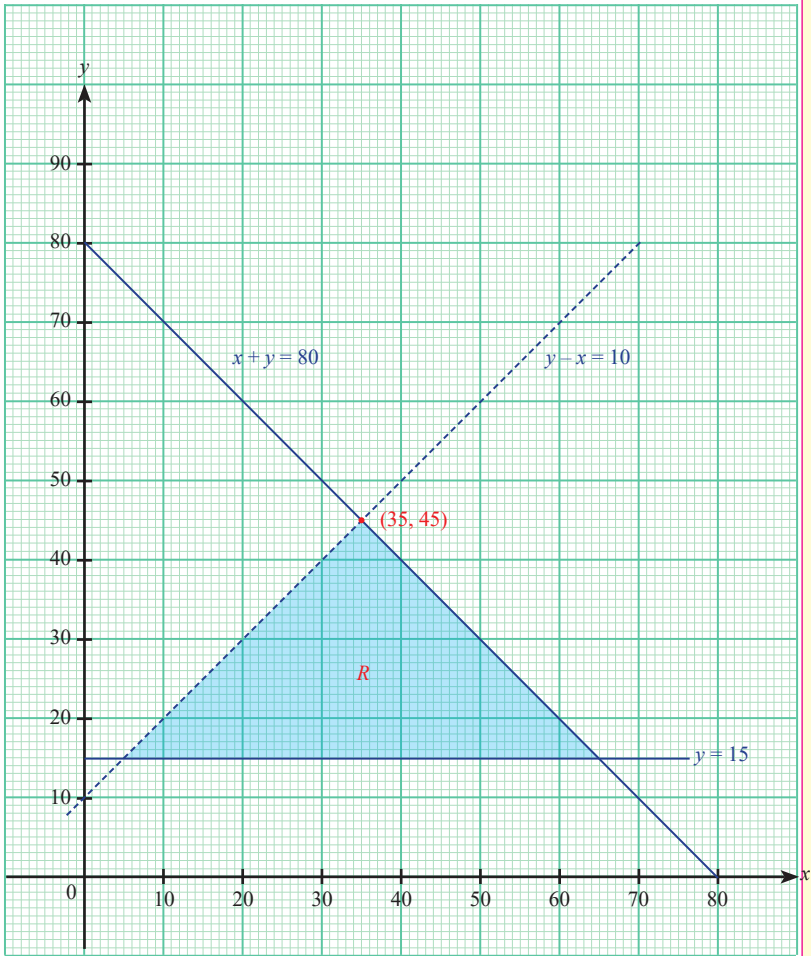
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
3	(a) $gf(x) = 3x - 4$, $f(x) = x + 2$ $g(x + 2) = 3x - 4$ $f^{-1}(x) = y$ $f(y) = x$ $y + 2 = x$ $y = x - 2$ $f^{-1}(x) = x - 2$ $g(x) = gf[f^{-1}(x)]$ $= 3(x - 2) - 4$ $= 3x - 10$	1 1 1	7
	(b) (i) $f^2(x) = ff(x)$ $= (x + 2) + 2$ $= x + 4$ (ii) $f^3(x) = ff^2(x)$ $= (x + 4) + 2$ $= x + 6$ $f^n(x) = x + 2n$	1 1 1 1	
	4 (a) $f(x) = (x - 3)^2 + k$ $f(0) = 5$ $(0 - 3)^2 + k = 5$ $9 + k = 5$ $k = -4$	1 1	
4	(b) (i) $f(x) = (x - 3)^2 - 4$ $= x^2 - 6x + 9 - 4$ $= x^2 - 6x + 5$ $f(x) = 0$ $x^2 - 6x + 5 = 0$ $(x - 1)(x - 5) = 0$ $x = 1, 5$ Punca-punca bagi graf fungsi $f(x)$ dan $g(x)$ ialah 1 dan 5. The roots of graph $f(x)$ and graph $g(x)$ are 1 and 5. $g(1) = 0$ $-3(1)^2 + (m - 4)(1) - 15 = 0$ $-3 + m - 4 - 15 = 0$ $m - 22 = 0$ $m = 22$	1 1 1	7
	(ii) $g(x) = -3x^2 + 18x - 15$ $= -3(x^2 - 6x + 5)$ $= -3\left[x^2 - 6x + \left(\frac{-6}{2}\right)^2 - \left(\frac{-6}{2}\right)^2 + 5\right]$ $= -3(x - 3)^2 + 12$ Titik maksimum / Maximum point = (3, 12)	1 1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
5	(a) (i) $2 \cot^2 A \sin^2 A = 2 \left(\frac{\cos^2 A}{\sin^2 A} \right) \sin^2 A$ $= 2 \cos^2 A$ $= (2 \cos^2 A - 1) + 1$ $= 1 + \cos 2A$ $2 \cot^2 A \sin^2 A = 2 \left(\frac{\cos^2 A}{\sin^2 A} \right) \sin^2 A$ $= 2 \cos^2 A$ $= (2 \cos^2 A - 1) + 1$ $= 1 + \cos 2A$ (ii) $2 \cot^2 A \sin^2 A = \frac{1}{2}$ $1 + \cos 2A = \frac{1}{2}$ $\cos 2A = -\frac{1}{2}$ $\alpha = \cos^{-1} \left(\frac{1}{2} \right) = \frac{\pi}{3}$ $2 \cot^2 A \sin^2 A = \frac{1}{2}$ $1 + \cos 2A = \frac{1}{2}$ $\cos 2A = -\frac{1}{2}$ $\alpha = \cos^{-1} \left(\frac{1}{2} \right) = \frac{\pi}{3}$ $2A = \pi - \frac{\pi}{3}, \pi + \frac{\pi}{3}$ $A = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$	1 1 1 1 1	9
	(b) 	4	
6	(a) (i) $\vec{OX} = \vec{OA} + \vec{AX}$ $= 4\vec{a} + \vec{b}$ (ii) $\vec{BY} = \vec{BA} + \vec{AY}$ $= -3\vec{b} + (-\vec{a})$ $= -3\vec{b} - \vec{a}$	1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) $\frac{dA}{dt} = 36 \text{ cm}^2 \text{ s}^{-1}, x = \sqrt{5}$ $\frac{dA}{dt} = \frac{dA}{dx} \times \frac{dx}{dt}$ $36 = [26 - 4(\sqrt{5})] \times \frac{dx}{dt}$ $\frac{dx}{dt} = 2.11 \text{ cm s}^{-1}$ $x = \int \left(\frac{dx}{dt}\right) dt$ $= \int 2.11 dt$ $= 2.11t + c$ $t = 0, x = \sqrt{5}$ $\sqrt{5} = 2.11(0) + c$ $c = \sqrt{5}$ $x = 2.11t + \sqrt{5}$ $t = 3, x = 2.11(3) + \sqrt{5}$ $= 8.57 \text{ cm}$	2 1 1	10
	(c) $\delta x = 1.98 - 2 = -0.02 \text{ cm}$ $\delta A \approx \frac{dA}{dx} \times \delta x$ $\approx [26 - 4(2)] \times (-0.02)$ $\approx -\frac{9}{25} \text{ cm}^2$	1 1	
	9 (a) (i) $(x, y) = \left(\frac{3+7}{2}, \frac{2+(-6)}{2}\right)$ $= (5, -2)$ $(5, -2) = \left(\frac{2x+3(-1)}{2+3}, \frac{2y+3(-8)}{2+3}\right)$ $5 = \frac{2x-3}{5} \quad -2 = \frac{2y-24}{5}$ $25 = 2x - 3 \quad -10 = 2y - 24$ $2x = 28 \quad 2y = 14$ $x = 14 \quad y = 7$ $D(14, 7)$ (ii) Luas / Area $\triangle CDE$ $= \frac{1}{2} \begin{vmatrix} 5 & 14 & 7 & 5 \\ -2 & 7 & -6 & -2 \end{vmatrix}$ $= \frac{1}{2} [5 \times 7 + 14 \times (-6) + 7 \times (-2)] - [-2 \times 14 + 7 \times 7 + (-6) \times 5] $ $= \frac{1}{2} -54 $ $= 27 \text{ unit}^2$	1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks													
10	(b) (i) $m_{PA} = \frac{y-2}{x-3}, m_{PB} = \frac{y-(-8)}{x-(-1)}$	1	10													
	$\left(\frac{y-2}{x-3}\right)\left(\frac{y-(-8)}{x-(-1)}\right) = -1$	1														
	$y^2 + 8y - 2y - 16 = -(x^2 + x - 3x - 3)$	1														
	$x^2 + y^2 - 2x + 6y - 19 = 0$															
	(ii) $x = 5, y = -2$	1														
	$5^2 + (-2)^2 - 2(5) + 6(-2) - 19 = -12$															
	$-12 \neq 0$, maka lokus P tidak melalui C	1														
	$-12 \neq 0$, therefore locus P does not pass through point C	1														
10	(a)															
	<table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>xy</td><td>3.25</td><td>2.56</td><td>1.74</td><td>1.00</td><td>0.25</td><td>-0.54</td></tr></table> 	x	1	2	3	4	5	6	xy	3.25	2.56	1.74	1.00	0.25	-0.54	1
x	1	2	3	4	5	6										
xy	3.25	2.56	1.74	1.00	0.25	-0.54										
		3														

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) (i) $y^2 = \frac{4}{x^2}$ $x^2 y^2 = 4$ $(xy)^2 = 4$ $xy = 2$ $x = 2.65$ (ii) $y + \sqrt{h} = \frac{k^2}{x}$ $xy + x\sqrt{h} = k^2$ $xy = (-\sqrt{h})x + k^2$ $m = \frac{4-1}{0-4}$ $= -\frac{3}{4}$ $m = -\sqrt{h}$ $-\sqrt{h} = -\frac{3}{4}$ $\sqrt{h} = \frac{3}{4}$ $h = \frac{9}{16}$ $c = k^2$ $k^2 = 4$ $k = 2$	1 1 1 1 1 1	10
11	(a) (i) $n = 5\,000, p = \frac{97}{1+97+2} = 0.97$ $\mu = np$ $= (5\,000)(0.97)$ $= 4\,850$ (ii) $p = 0.03, q = 0.97, n = 6, r = 2$ $P(X = 2) = {}^6C_2(0.03)^2(0.97)^4$ $= 0.01195$ (iii) $n = 10, p = \frac{1}{3}, q = \frac{2}{3}, r > 2$ $P(X > 2) = 1 - P(X \leq 2)$ $= 1 - P(X = 0) - P(X = 1) - P(X = 2)$ $= 1 - {}^{10}C_0\left(\frac{1}{3}\right)^0\left(\frac{2}{3}\right)^{10} - {}^{10}C_1\left(\frac{1}{3}\right)^1\left(\frac{2}{3}\right)^9 - {}^{10}C_2\left(\frac{1}{3}\right)^2\left(\frac{2}{3}\right)^8$ $= 1 - 0.0173 - 0.0867 - 0.1951$ $= 0.7009$	1 1 1 1 1	
	(b) $P(X > k) = \frac{1}{4} [P(X \leq k)]$ 		

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) (i)  (ii) $\angle A'B'C' = 37^\circ$	1 1	10
15	(a) I : $x + y \leq 80$ II : $y - x < 10$ III : $y \geq 15$ (b) 	1 1 1 3	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(c) (i) 44	1	10
	(ii) Titik maksimum / <i>Maximum point</i> = (36, 44)	1	
	$a(36) + 4(36) + a(44) = 400$	1	
	$80a = 400 - 144$		
	$a = 3.2$		
	Baki bayaran murid kelas B <i>The balance of payment by a student of class B</i> = RM3.20	1	

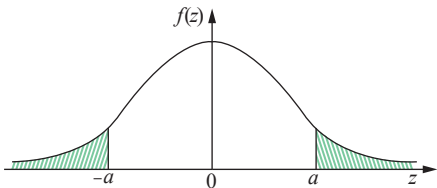
SIJIL PELAJARAN MALAYSIA 2022

KERTAS 1

Bahagian A

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
1	(a) $x = 6$	1	3
	(b) $\frac{3p}{6-2} = 9$	1	
	$3p = 36$ $p = 12$	1	
2	(a) (i) $x^{2k+p} = x^0$ $2k + p = 0$ $p = -2k$	1	4
	(ii) $a^p = (a^{1/k})^6$ Bandingkan kuasa / <i>Comparing power</i> $p = \frac{1}{k}(6)$ $p = \frac{6}{k}$	1	
	(b) $3^{y-2x-2} = 34$ Bandingkan kuasa / <i>Comparing power</i> $y - 2x - 2 = 4$ $y = 2x + 6$	1	
3	(a) Jika / <i>If</i> $\log_a mn = p, mn = a^p$ $\log_a m = q, m = a^q$ $\log_a n = r, n = a^r$	1	6
	Jadi / <i>So</i> , $mn = a^q a^r = a^{q+r}$	1	
	Maka / <i>Then</i> , $\log_a mn = q + r = \log_a m + \log_a n$	1	
	(b) $\log_u (u+3)(u-1) = 2$	1	
	$(u+3)(u-1) = u^2$ $u^2 + 2u - 3 = u^2$ $2u = 3$ $u = \frac{3}{2}$	1	

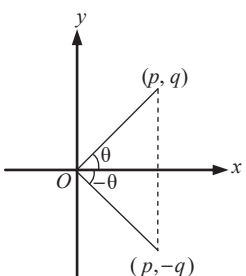
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
4	$(a) \frac{dV}{dt} = \frac{-5.5}{60} \text{ cm}^3 \text{ s}^{-1}$ $V = x^3$ $\frac{dV}{dx} = 3x^2$ Bila / When $x = 15$, $\frac{dV}{dx} = 3(15)^2$ $= 675$ $\frac{dx}{dt} = \frac{dx}{dV} \times \frac{dV}{dt}$ $= \frac{1}{dV} \times \frac{dV}{dt}$ $= \frac{1}{675} \times \frac{-5.5}{60}$ $= \frac{-11}{81\,000}$	1	6
	$(b) \int [2g(x) + 3] \, dx$ $= \int 2g(x) \, dx + \int 3 \, dx$ $= 2\left(\frac{5}{1-x^2}\right) + 3x + c$	2	
		1	
		1	
5	$\vec{OP} = 2\vec{i} + 3\vec{j}$ $\vec{OQ} = q\vec{i} + 2q\vec{j}$ $\vec{PQ} = \vec{PO} + \vec{OQ}$ $= -2\vec{i} - 3\vec{j} + q\vec{i} + 2q\vec{j}$ $= (-2 + q)\vec{i} + (-3 + 2q)\vec{j}$ Vektor unit / Unit vector, $\vec{PQ} = 1$ Maka / Then, $\sqrt{(-2 + q)^2 + (-3 + 2q)^2} = 1$ $4 - 4q + q^2 + 9 - 12q + 4q^2 = 1$ $5q^2 - 16q + 12 = 0$ $(5q - 6)(q - 2) = 0$ $q = \frac{6}{5}, q = 2$	1	4
		1	
		1	
		1	
6	$y = \frac{px}{qx - 1}$ $\frac{1}{y} = \frac{qx - 1}{px}$ $\frac{1}{y} = \frac{q}{p} - \frac{1}{px}$ $\frac{1}{y} = -\frac{1}{p} \left(\frac{1}{x} \right) + \frac{q}{p}$ $-\frac{1}{p} = \frac{1}{8}$ $p = -8$	1	
		1	

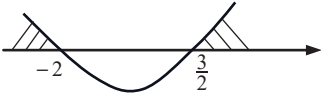
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	Ganti / Substitute, $p = -8, x = \frac{1}{2}, y = -6$ $-6 = \frac{(-8)\left(\frac{1}{2}\right)}{q\left(\frac{1}{2}\right) - 1}$ $-3q + 6 = -4$ $3q = 10$ $q = \frac{10}{3}$	1 1	4
7	(a) $\frac{120\pi}{180} = \frac{2}{3}\pi$ (b) $\angle AOB = \frac{60(3.142)}{180}$ $= 1.047 \text{ rad}$ $h + h + 1.047h = 15.235$ $3.047h = 15.235$ $h = 5$ $\frac{1}{2}(5)^2(1.047) - \frac{1}{2}(k)^2(1.047) = 8.376$ $k^2 = 9$ $k = 3, k = -3$ (abai / ignore) $k = 3$	1 2 1 2 1	7
8	(a)  (b) (i) $k = 0.431$ (ii) Mod bahagian A / Mode for part A $k = -0.431$	1 1 1	3
9	(a) Benar. Saiz kasut boleh dibilang. True. Shoe sizes can be counted. (b) (i) $P(X \leq 1) = 11P(X = 0)$ ${}^nC_0(p^0)(q^n) + {}^nC_1(p^1)(q^{n-1}) = 11{}^nC_0(p^0)(q^n)$ $q^n + npq^{n-1} = 11q^n$ $npq^{n-1} = 10q^n$ $\frac{npq^n}{q} = 10q^n$ Banding / Compare, $\frac{np}{q} = 10$ $n(1 - q) = 10q$ (ii) $n(1 - q) = 10q$ $np = 10q$ $6 = 10q$ $q = \frac{3}{5}, p = \frac{2}{5}$	1 1 1 1 1	5

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
10	(a) (i) $\frac{RM24}{4} = 6$ ${}^{10}C_6 = 210$ cara / ways	1	8
	(ii) $({}^8C_4 \times {}^{10}C_4) + ({}^8C_6 \times {}^{10}C_3) + ({}^8C_8 \times {}^{10}C_2)$ $= 18\,105$ cara / ways	2 1	
	(b) (i) $1 \times 1 \times 1 \times 59 \times 58 = 3\,422$ (ii) $21 \times 4 \times 4 \times 58 \times 62$ (huruf besar bukan vokal diikuti 2 nombor perdana) (non-vowel capital letter followed by 2 prime numbers) + $21 \times 4 \times 4 \times 4 \times 58$ (huruf besar bukan vokal diikuti 3 nombor perdana) (non-vowel capital letter followed by 3 prime numbers) + $21 \times 4 \times 4 \times 4 \times 4$ (huruf besar bukan vokal diikuti 4 nombor perdana) (non-vowel capital letter followed by 4 prime numbers)	1 2	
	$= 1\,291\,584$ cara / ways	1	
11	$BD = \sqrt{(2+x)^2 - (2-x)^2}$ $= \sqrt{8x}$	1	5
	$\sqrt{x} + \sqrt{8x} = \sqrt{1 + \sqrt{2}}$	1	
	Kuasa dua kedua-dua bahagian / Squaring both sides, $(\sqrt{8x} + \sqrt{x})^2 = (\sqrt{1 + \sqrt{2}})^2$ $9x + 2x\sqrt{8} = 1 + \sqrt{2}$ $x(9 + 2\sqrt{8}) = 1 + \sqrt{2}$		
	$x = \frac{1 + \sqrt{2}}{9 + 2\sqrt{8}} \times \frac{9 - 2\sqrt{8}}{9 - 2\sqrt{8}}$	1	
	$= \frac{9 + 5\sqrt{2} - 8}{(9)^2 - (2\sqrt{8})^2}$ $= \frac{1 + 5\sqrt{2}}{(9)^2 - (2\sqrt{8})^2}$ $= \frac{1 + 5\sqrt{2}}{49}$	1 1 1	
12	(a) $T_1 = a,$ $T_2 = a + d,$ $T_3 = a + d + d$ $= a + 2d$	1	
	$T_1 = a + (1 - 1)d$ $T_2 = a + (2 - 1)d$ $T_3 = a + (3 - 1)d$	1	
	Jadi / So, $T_n = a + (n - 1)d$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) (i) $\frac{1}{2} \times 12 \times x = 72$ $x = 12$ $T_{31} = a + (31 - 1)d$ $= 12$ Diberi / Given, $a = 30d$ $30d + (31 - 1)d = 12$ $60d = 12$ $d = \frac{1}{5}$ (ii) $a = 30\left(\frac{1}{5}\right)$ $= 6$ Luas / Area $= S_{31} \times 12 \times 4 \times 10^{-5} \text{ cm}^2 \text{ kg}$ $= \frac{31}{2} \left[2(6) + (31 - 1)\left(\frac{1}{5}\right) \right] \times 12 \times 4 \times 10^{-5} \text{ cm}^2 \text{ kg}$ $= 0.1339 \text{ cm}^2 \text{ kg}$ RM9: $\frac{2.5}{0.1339} \approx 18$ gulungan / rolls RM6: RM1.20 setiap / every 0.5 kg $\rightarrow$ RM2.40 setiap kg / every kg $\frac{6}{2.4} = 2.5$ kg $\frac{2.5}{0.1339} \approx 18$ gulungan / rolls $18 + 18 = 36$ gulungan / rolls $36 \times 0.1339 \text{ kg} = 4.821 \text{ kg}$ $5 - 4.821 \text{ kg} = 0.179 \text{ kg} \rightarrow 1$ gulung lagi / more roll Bilangan gulungan maksimum = $36 + 1$ The number of maximum rolls is $= 37$	1 1 1 2 1	9

Bahagian B

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
13	(a) (i)  (ii) $\tan(-\theta) = -\tan \theta$ $= -\frac{q}{p}$	1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) $2 \cos x = \sqrt{3} \cot x$ $2 \cos x = \sqrt{3} \frac{\cos x}{\sin x}$ $2 \cos x \sin x - \sqrt{3} \cos x = 0$ $\cos x (2 \sin x - \sqrt{3}) = 0$ $\cos x = 0, \quad \sin x = \frac{\sqrt{3}}{2}$ $x = 90^\circ, 270^\circ \quad x = 60^\circ, 120^\circ$ $x = 60^\circ, 90^\circ, 120^\circ, 270^\circ$	1	8
	(c) $\tan m = \frac{p}{1}$ dalam sukuan 3 / in quadrant 3	1	
	$\cos m = -\frac{1}{\sqrt{1+p^2}}, \quad \sin m = -\frac{p}{\sqrt{1+p^2}}$	1	
	$\cos\left(\frac{\pi}{3} - m\right) = \cos \frac{\pi}{3} \cos m + \sin \frac{\pi}{3} \sin m$ $= \frac{1}{2} \cos m + \frac{\sqrt{3}}{2} \sin m$ $= -\frac{1}{2\sqrt{1+p^2}} - \frac{\sqrt{3}p}{2\sqrt{1+p^2}}$ $= \frac{-\sqrt{3}p - 1}{2\sqrt{1+p^2}}$	1	
		1	
14	(a) $-\frac{1}{4} + \left[-\frac{1}{4} - -2\right] = \frac{3}{2}$  $x < -2, x > \frac{3}{2}$	1	8
		1	
	(b) $h^2 - 4(2)(-2k + 5) > 0$ $h^2 + 16k - 40 > 0$ $k > \frac{40 - h^2}{16}$	1	
		1	
	(c) $f(x) = 2\left[x^2 + \frac{h}{2}x\right] - 2k + 5$ $= 2\left[x^2 + \frac{h}{2}x + \left(\frac{h}{2}\right)^2 - \left(\frac{h}{2}\right)^2\right] - 2k + 5$ $= 2\left(x + \frac{h}{4}\right)^2 - 2\left(\frac{h}{4}\right)^2 - 2k + 5$ $= 2\left(x + \frac{h}{4}\right)^2 - \frac{h^2}{8} - 2k + 5$ $-\frac{h}{4} = -\frac{1}{4}$ $h = 1$ Nilai minimum / Minimum value $= -\frac{1^2}{8} - 2k + 5$ $= \frac{39}{8} - 2k$	1	
		1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
15	(a) $\frac{y_2 - y}{y - y_1} = \frac{n}{m}$ $my_2 - my = ny - ny_1$ $my_2 + ny_1 = ny + my$ $y(n + m) = my_2 + ny_1$ $y = \frac{ny_1 - my_2}{m + n}$	1	8
	(b) $PR = 2.5x$	1	
	$\sqrt{\left(x - \frac{3}{2}\right)^2 + \left[y - \left(-\frac{1}{2}\right)\right]^2} = 2.5x$	1	
	$\left(\frac{2x-3}{2}\right)^2 + \left(\frac{2y+1}{2}\right)^2 = \left(\frac{5x}{2}\right)^2$		
	$\frac{4x^2 - 12x + 9}{4} + \frac{4y^2 + 4y + 1}{4} = \frac{25x^2}{4}$		
	$-21x^2 - 12x + 4y^2 + 4y + 10 = 0$	1	
(c)	$\frac{1}{2} \begin{vmatrix} 1 & 8 & 0 & 2 \\ 12 & 9 & y & 12 \end{vmatrix} = 30$	1	8
	$ 2(9) + 8y + 0(12) - 12(8) - 9(0) - 2y = 60$	1	
	$ 18 + 8y - 96 - 2y = 60$		
	$18 + 8y - 96 - 2y = 60$ $y = 23$ (Abaikan / Ignore)		
atau / or	$18 + 8y - 96 - 2y = -60$		8
	$y = 3$	1	

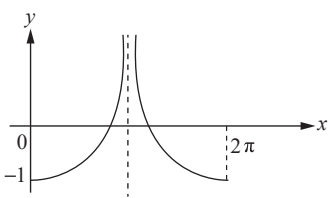
KERTAS 2

Bahagian A

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
1	(a) $g^{-1}(x) = \pm\sqrt{x+3}$	1	7
	Tidak. Fungsi g tidak mempunyai songsangan. No. Function g does not have inverse.	1	
	(b) (i) $h(x) = fg(x)$ $= 1 - 2(x^2 - 3)$ $= 7 - 2x^2$	2	
	(ii) $f^{-1}(x) = \frac{1-x}{2}$	1	
	$\left(\frac{1-x}{2}\right)^2 - 3 = 1$	1	
	$(1-x)^2 = 16$ $1-x = \pm 4$ $x = -3, 5$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
2	(a) (i) $-2m = -1$ $m = \frac{1}{2}$ $y - (-2) = \frac{1}{2}(x + 8)$ $y = \frac{1}{2}x + 2$	1 1 1	7
	(ii) $\frac{1}{2}x + 2 = -2x - 3$ $\frac{5}{2}x = -5$ $x = -2$ $y = -2(-2) - 3$ $= 1$ $\therefore Q(-2, 1)$	1	
	(b) $(-2, 1) = \left[\frac{2(-8) + 3(x)}{2 + 3}, \frac{2(-2) + 3(y)}{2 + 3} \right]$ $\frac{-16 + 3x}{5} = -2$ $x = 2$ $\frac{-4 + 3y}{5} = 1$ $y = 3$ $\therefore T(2, 3)$	1 1	
3	(a) $\frac{5}{2} = \alpha + \beta$ $\frac{p}{2} = \alpha\beta$ $2\alpha - 1 + 2\beta - 1 = 2(\alpha + \beta) - 2$ $= 2\left(\frac{5}{2}\right) - 2$ $= 3$	1	
	$(2\alpha - 1)(2\beta - 1) = 4\alpha\beta - 2(\alpha + \beta) + 1$ $= 4\left(\frac{p}{2}\right) - 2\left(\frac{5}{2}\right) + 1$ $= 2p - 4$	1	
	$x^2 - (3)x + (2p - 4) = 0$ $x^2 - 3x + 2p - 4 = 0$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) $2x^2 - 5x + p = x + 1$ $2x^2 - 6x + p - 1 = 0$ $(-6)^2 - 4(2)(p - 1) = 0$ $36 - 8p + 8 = 0$ $p = \frac{44}{8}$ $p = \frac{11}{2}$	1 1 1	6
4	(a) $S_4 = 16(S_8 - S_4)$ $\frac{a(r^4 - 1)}{r - 1} = 16 \left[\frac{a(r^8 - 1)}{r - 1} - \frac{a(r^4 - 1)}{r - 1} \right]$ $\left[\frac{a(r^4 - 1)}{r - 1} \right] \times \frac{(r - 1)}{a} = 16 \left[\frac{a(r^8 - 1)}{r - 1} - \frac{a(r^4 - 1)}{r - 1} \right] \times \frac{(r - 1)}{a}$ $r^4 - 1 = 16r^8 - 16r^4$ $r^4 - 1 = 16r^8 - 16r^4$ $16r^8 - 17r^4 + 1 = 0$ Katakan / Let $x = r^4$, $16x^2 - 17x + 1 = 0$ $(x - 1)(16x - 1) = 0$ $x = r^4 = 1$ $r = \pm 1$ (Mustahil / Impossible) $x = r^4 = \frac{1}{16}$ $r = \pm \frac{1}{2} \text{ (Abai negatif / Ignore negative)}$ $r = \frac{1}{2}$	1 1 1	
	(b) (i) $T_8 - T_4 = 120$ $ar^7 - ar^3 = 120$ $a\left(\frac{1}{2}\right)^7 - a\left(\frac{1}{2}\right)^3 = 120$ $\frac{-15}{128} a = 120$ $a = \frac{120}{-\frac{15}{128}}$ $a = -1\,024$ (ii) $S_\infty = \frac{-1\,024}{1 - \left(\frac{1}{2}\right)}$ $= -2\,048$	1 1 1 1	7

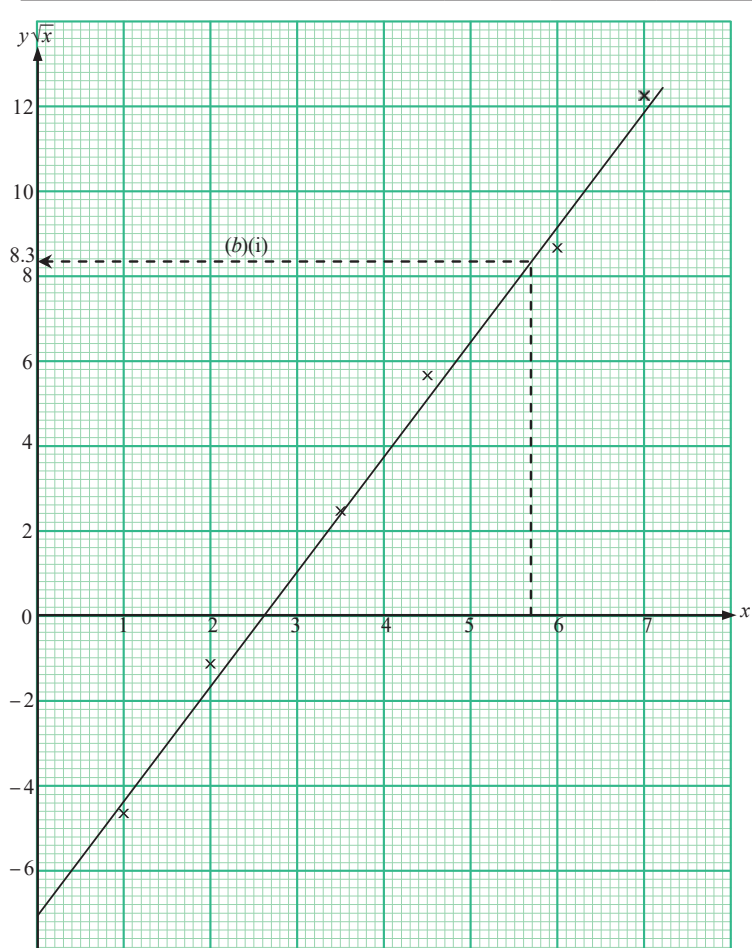
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
5	$AB = 2 \times \text{Panjang lengkok} / \text{Length of the arc } PQ:$ $y = 2\left(\frac{3}{2}\pi x\right)$ $y = 3\pi x \dots\dots ①$ Luas kawasan tak berumput / <i>Area of the non-grass region:</i> $6xy - \frac{1}{4}(3x)^2(\pi) = (90x + 27)\pi \dots\dots ②$ Ganti / <i>Substitute</i> ① ke dalam / <i>into</i> ②: $6x(3\pi x) - \frac{1}{4}(3x)^2(\pi) = (90x + 27)\pi \dots\dots ③$ $③ \times \frac{1}{\pi}:$ $18x^2 - \frac{9x^2}{4} = 90x + 27$ $21x^2 - 120x - 36 = 0$ $7x^2 - 40x - 12 = 0$ $(x - 6)(7x + 2) = 0$ $x = 6, x = -\frac{2}{7}$ (Abai / <i>Ignore</i>) Ganti / <i>Substitute</i> $x = 6$ ke dalam / <i>into</i> ①: $y = 3\pi(6)$ $= 18\pi \text{ atau / or } 56.56$	2 1 1 1 1 1 1	7
6	(a) $\cot \frac{x}{2} - \tan \frac{x}{2}$ $= \frac{1}{\tan \frac{x}{2}} - \tan \frac{x}{2}$ $= \frac{1 - \tan^2 \frac{x}{2}}{\tan \frac{x}{2}}$ $= \frac{1}{\left(\frac{\tan \frac{x}{2}}{1 - \tan^2 \frac{x}{2}}\right)}$ $= \frac{1}{\frac{1}{2} \tan x}$ $= 2 \cot x$	1 1	
	(b) (i)  (ii) $m < -1$	3 1	6

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
7	(a) (i) $\frac{dy}{dx} : 6 - 2x = 0$ $x = 3$	1	10
	$EH = 3 - p + 2p$ $= 3 + p$	1	
	(ii) $\int \frac{dy}{dx} = \int 6 - 2x$ $y = 6x - x^2 + c \dots\dots \textcircled{1}$		
	Ganti / Substitute (0, 0) ke dalam / into $\textcircled{1}$	1	
	$0 = 6(0) - 0^2 + c$ $c = 0$		
	$y = 6x - x^2 \dots\dots \textcircled{2}$		
	Ganti / Substitute $x = 3 + p$ ke dalam / into $\textcircled{2}$		
	$y = 6(3 + p) - (3 + p)^2$ $= 9 - p^2$	1	
	Luas / Area, $L = (9 - p^2 - 1)(2p)$ $= 16p - 2p^3$	1 1	
	(b) Luas maksimum / Maximum area:		
	$\frac{dL}{dx} = 0$ $16 - 6p^2 = 0$ $p^2 = \pm \sqrt{\frac{8}{3}}$ $p = 1.633$	1 1	
	Jumlah kos / Total cost = $40 \times [16(1.633) - 2(1.633)^3]$ $= \text{RM}697$	2	

Bahagian B

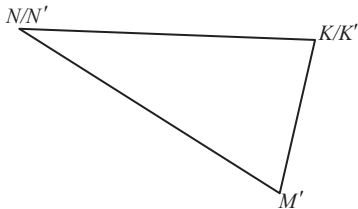
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
8	(a) (i) $\overrightarrow{OP} = \overrightarrow{OA} + \overrightarrow{AP}$	1	
	$= \underline{a} + \frac{1}{3}(-\underline{a} + \underline{b})$		
	$= \frac{2}{3}\underline{a} + \frac{1}{3}\underline{b}$	1	
	(ii) $\overrightarrow{BQ} = \overrightarrow{BO} + \overrightarrow{OQ}$		
	$= -\underline{b} + k\left(\frac{2}{3}\underline{a} + \frac{1}{3}\underline{b}\right)$ $= -\underline{b} + \frac{2}{3}k\underline{a} + \frac{k}{3}\underline{b}$	1 1	

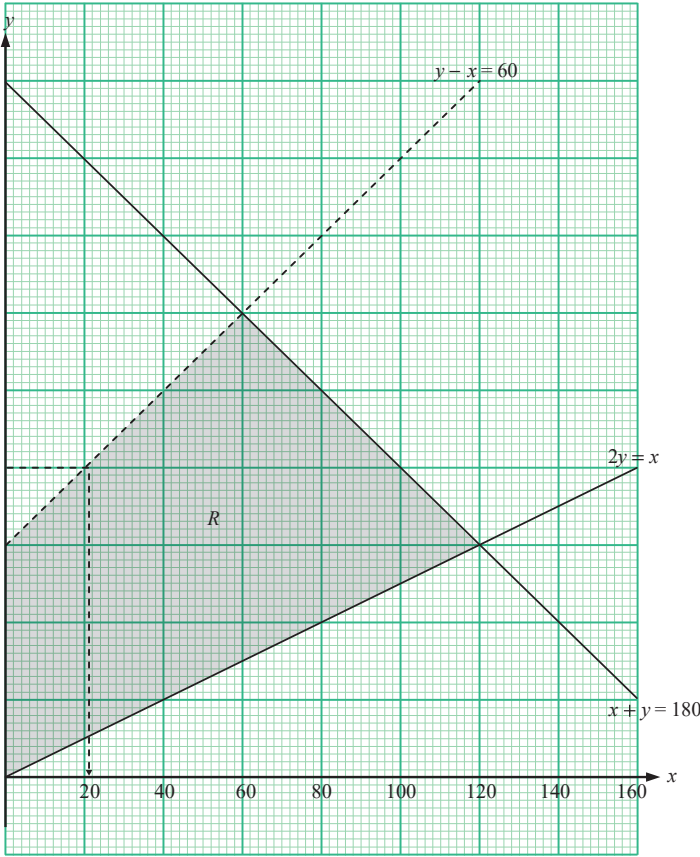
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) $\overrightarrow{BQ} = h\overrightarrow{BC}$ $-\underline{b} + \frac{2}{3}k\underline{a} + \frac{k}{3}\underline{b} = h(-\underline{b} + 3\underline{a})$ $\left(-1 + \frac{k}{3}\right)\underline{b} + \frac{2}{3}k\underline{a} = -h\underline{b} + 3h\underline{a}$ Banding / Compare: $-1 + \frac{k}{3} = -h$ $\frac{2}{3}k = 3h$ $\frac{2}{3}k = 3\left(1 - \frac{k}{3}\right)$ $k = \frac{9}{5}$ $h = 1 - \frac{9}{15} = \frac{2}{5}$	1 1 1 2	10
	(c) $5BQ = 2BC$ $BQ : QC = 2 : 3$	1	
9	(a) (i) ${}^8C_8(0.9772^8)(0.0228^0)$ $= 0.8315$	1 1	10
	(ii) $P(X \leq 6)$ $= 1 - {}^8C_8(0.9772^8)(0.0228^0) - {}^8C_7(0.9772^7)(0.0228^1)$ $= 0.0133$	2 1	
	(b) $\frac{61 - 60}{\sigma} = 1.999$ $\sigma = 0.5$	2 1	
	$P(X < 60.5)$ $= P\left(Z < \frac{60.5 - 60}{0.5}\right)$ $= P(Z < 1)$ $= 1 - P(Z \geq 1)$ $= 0.8413$	1 1	
10	(a) $\frac{dy}{dx} = \frac{1}{2}(x+9)^{-\frac{1}{2}}(1)$ $= \frac{1}{2}(-5+9)^{-\frac{1}{2}}$ $= \frac{1}{4}$	1 1	
	(b) $h = \sqrt{-5+9}$ $= \pm 2$ $\therefore h = 2$ $\int_{-9}^{-5} (x+9)^{\frac{1}{2}} = \left[\frac{2}{3}(x+9)^{\frac{3}{2}}\right]_{-9}^{-5}$ $= \frac{2}{3}(-5+9)^{\frac{3}{2}} - \frac{2}{3}(-9+9)^{\frac{3}{2}}$ $= \frac{16}{3}$	1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks													
	Luas kawasan berlorek / <i>Shaded area region</i> $= \frac{1}{2} \left(2 + \frac{3}{2} \right) (5) + \frac{16}{3}$ $= 14.08$	2 1	10													
	(c) $\pi \int_0^2 (y^2 - 9)^2 \, dy$ $= \pi \int_0^2 y^4 - 18y^2 + 81 \, dy$ $= \pi \left[\frac{y^5}{5} - \frac{18y^3}{3} + 81y \right]_0^2$ $= \pi \left[\frac{y^5}{5} - 6y^3 + 81y \right]_0^2$ $= \pi \left[\frac{(2)^5}{5} - 6(2)^3 + 81(2) \right] - \pi \left[\frac{(0)^5}{5} - 6(0)^3 + 81(0) \right]$ $= 120.4\pi$	1 1 1														
11	(a) <table border="1"><tr><td>x</td><td>1.0</td><td>2.0</td><td>3.5</td><td>4.5</td><td>6.0</td><td>7.0</td></tr><tr><td>$y\sqrt{x}$</td><td>-4.70</td><td>-1.12</td><td>2.41</td><td>5.60</td><td>8.60</td><td>12.20</td></tr></table> 	x		1.0	2.0	3.5	4.5	6.0	7.0	$y\sqrt{x}$	-4.70	-1.12	2.41	5.60	8.60	12.20
x	1.0	2.0	3.5	4.5	6.0	7.0										
$y\sqrt{x}$	-4.70	-1.12	2.41	5.60	8.60	12.20										

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) (i) $x = 5.7, y\sqrt{x}$ $y\sqrt{5.7} = 8.3$ $y = 3.476$ (ii) $y\sqrt{x} = \frac{b}{a}x + \frac{1}{a}$ $m = \frac{2.41 - (-7)}{3.5 - 0}$ $= 2.689$ $\frac{1}{a} = -7$ $a = -\frac{1}{7}$ $\frac{b}{-\frac{1}{7}} = 2.689$ $b = -0.3841$	1 1 2 2	10

Bahagian C

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
12	(a) (i) $(\sqrt{p})^2 = 10^2 + 12^2 - 2(10)(12) \cos 60^\circ$ $p = 124$	1 1	10
	(ii) $\frac{MN}{\sin 40^\circ} = \frac{\sqrt{124}}{\sin 110^\circ}$ $MN = 7.617$	2 1	
	Luas / Area $= \frac{1}{2}(10)(12) \sin 60^\circ + \frac{1}{2}(\sqrt{124})(7.617) \sin 30^\circ$ $= 73.16$	2 1	
	(b) 	1	
	$\angle N'K'M' = 80^\circ$	1	
13	(a) $x + y \leq 180$ $y - x < 60$ $y \geq \frac{1}{2}x$	1 1 1	

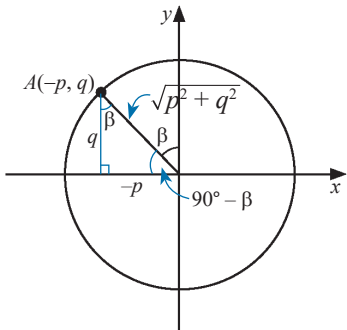
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) 	3	10
14	(c) (i) 120 (ii) (21, 80) Untung maksimum / Maximum profit $= -5.5(21) + 40(80)$ $= \text{RM3 084.50}$	1 1 1 1	
	(a) (i) $\frac{z}{15}(100) = 130$ $z = \text{RM19.50}$ (ii) $\frac{y}{x}(100) = 140, x + 6 = y$ $140x = (x + 6)100$ $x = \text{RM15}$ $15 + 6 = y$ $y = \text{RM21}$	1 1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) $\frac{130(5) + 140p + 160q + 110(3)}{(5 + p + q + 3)} = 132$ $980 + 140p + 160q = 1\ 056 + 132p + 132q$ $8p = 1\ 056 - 980 - 28q$ $p = \frac{19}{2} - \frac{7}{2}q$	2 1	10
	(c) $\bar{I} = \frac{132 \times 120}{100}$ $= 158.4$ $\frac{x}{\text{RM}40} \times 100 = 158.4$ $x = \text{RM}63.36$ Harga biskut tahun 2022 / Biscuit's price in 2022 $= \frac{115}{100} \times \text{RM}63.36$ $= \text{RM}72.86$	 1 1	
	15 (a) Zarah A / Particle A $V_0 = 3(0)^2 + 8(0) + 5$ $= 5 \text{ m s}^{-1}$ Zarah B / Particle B $V_0 = 3(0)^2 - 2(0) + 4$ $= 4 \text{ m s}^{-1}$	1 2	
	(b) $S_A = S_B$ $t^3 + 4t^2 + 5t = t^3 - t^2 + 4t + 18$ $5t^2 + t - 18 = 0$ $(5t - 9)(t + 2) = 0$ $t = \frac{9}{5}$ dan / and $t = -2$ (Abai / Ignore) Jarak dilalui A ketika berlanggar / Distance travelled by A when colliding $= \left(\frac{9}{5}\right)^3 + 4\left(\frac{9}{5}\right)^2 + 5\left(\frac{9}{5}\right)$ $= 27.79$ Jarak dilalui B ketika berlanggar / Distance travelled by B when colliding $= 27.79 - 18$ $= 9.79$	1 1 1 1	
	(c) $t = \frac{9}{5}$ $a_A = 6t + 8$ $6\left(\frac{9}{5}\right) + 8 = 18.8$ $a_B = 6t - 2$ $6\left(\frac{9}{5}\right) - 2 = 8.8$	 1 1 1	

KERTAS 1

Bahagian A

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
1	(a) $y - x = 45 - 50$ $y - x = -5$	1	2
	(b) $\frac{y}{x} = \frac{45}{50}$ $\frac{y}{x} = \frac{9}{10}$	1	
2	p ialah nilai persilangan bagi paksi-y. / p is the value of y-intercept. $\therefore p = 2$ $\frac{x}{6} + \frac{y}{2} = 1$ $\frac{y}{2} = -\frac{x}{6} + 1$ $y = -\frac{1}{3}x + 2$ $\therefore m_1 = -\frac{1}{3}$ $y = qx$ $\therefore m_2 = q$ $\frac{x}{6} + \frac{y}{2} = 1 \text{ adalah berserenjang dengan } / \text{ is perpendicular to } y = qx$ $m_1 m_2 = -1$ $\left(-\frac{1}{3}\right) \times (q) = -1$ $q = 3$	1 1	3
3	(a) L_1 lebih sesuai kerana garis lurus tersebut melalui sebanyak mungkin titik dan terdapat jumlah titik yang sama di kedua-dua belah garis lurus. <i>L_1 is suitable because it passes through as many points as possible and there is equal number of points on both sides of the straight line.</i>	1	
	(b) $Y = mX + C$ $\frac{1}{y} = \frac{(7-4)}{(6-2)}(x^2) + C$ $\frac{1}{y} = \frac{3}{4}x^2 + C$ Pada / At (10, 9), $9 = \frac{3}{4}(10) + C$ $9 = \frac{15}{2} + C$ $\frac{3}{2} = C$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	$\frac{1}{y} = \frac{3}{4}x^2 + \frac{3}{2}$ $\frac{1}{y} = \frac{3x^2 + 6}{4}$ $\frac{y}{1} = \frac{4}{3x^2 + 6}$ $y = \frac{3}{4x^2 + 6}$	 1 1	4
4	 (a) $\tan \beta = -\frac{p}{q}$ (b) $\tan (180^\circ + \beta) = -\tan \beta$ $= -\left(-\frac{p}{q}\right)$ $= \frac{p}{q}$ $\cot / \cot (180^\circ + \beta) = \frac{1}{\tan (180^\circ + \beta)}$ $= \frac{1}{\frac{p}{q}}$ $= \frac{q}{p}$	 1 1	2
5	(a) $\overrightarrow{SP} = -2\mathbf{i} + 3\mathbf{j}$ (b) (i) $\overrightarrow{SP} + 3\overrightarrow{PQ} = 13\mathbf{i} + 15\mathbf{j}$ $(-2\mathbf{i} + 3\mathbf{j}) + 3(5\mathbf{i} + m\mathbf{j}) = 13\mathbf{i} + 15\mathbf{j}$ $-2\mathbf{i} + 3\mathbf{j} + 15\mathbf{i} + 3m\mathbf{j} = 13\mathbf{i} + 15\mathbf{j}$ $13\mathbf{i} + (3m + 3)\mathbf{j} = 13\mathbf{i} + 15\mathbf{j}$ $3m + 3 = 15$ $3m = 12$ $m = 4$	 1 1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(ii) $\overrightarrow{PQ} = 5\mathbf{i} + 4\mathbf{j}$ $ \overrightarrow{PQ} = \sqrt{5^2 + 4^2}$ $ \overrightarrow{PQ} = \sqrt{41}$ Vektor unit / Unit vector = $\frac{5\mathbf{i} + 4\mathbf{j}}{\sqrt{41}}$	1	5
6	(a) $f(7) = h$ $ 7 - 3 + 1 = h$ $ 4 + 1 = h$ $h = 5$ $f(x) = 5$ $ x - 3 + 1 = 5$ $ x - 3 = 4$ $x - 3 = 4$, $x - 3 = -4$ $x = 7$, $x = -1$ $\therefore$ Objek bagi h ialah -1 . <i>Object of h is -1.</i>	1	6
	(b) (i) $f(x) = 4x - 1$ Katakan / Let $4x - 1 = y$ $4x = y + 1$ $x = \frac{y + 1}{4}$ $f^{-1}(x) = \frac{x + 1}{4}$	1	
	$f^{-1}(p) = 2$ $\frac{p + 1}{4} = 2$ $p + 1 = 8$ $p = 7$	1	
	(ii) $fg(x) = 5f(2)$ $f(2x + 3) = 5[4(5) - 1]$ $4(2x + 3) - 1 = 5(20 - 1)$ $8x + 12 - 1 = 5(19)$ $8x + 11 = 95$ $8x = 84$ $x = 10\frac{1}{2}$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	Apabila / When $r = 5 \text{ cm}$, $4\pi(5)^2 = 100\pi$ $\frac{\delta r}{\delta v} \approx \frac{dr}{dv}$ $\frac{\delta r}{-20\pi} \approx \frac{1}{100\pi}$ $\delta r \approx -0.2$ $r_{\text{baru/new}} = r_{\text{lama/old}} + \delta r$ $= 5 \text{ cm} + (-0.2)$ $= 4.8 \text{ cm}$ $d_{\text{baru/new}} = 2(4.8 \text{ cm})$ $= 9.6 \text{ cm}$ Bilangan bola / Number of balls $\approx \frac{250 \text{ cm}}{9.6 \text{ cm}}$ ≈ 26.04 $= 26 \text{ biji bola / balls}$	1 1 1	9
	(b) $h(x) = 3x^2 + 7x - 8$ $h'(x) = 6x + 7$ $h''(x) = 6 > 0$ $\therefore h''(x) > 0$, titik pusingan minimum / minimum turning point.	1 1	
	(c) $\frac{dy}{dx} = (2x + 1)^3$ $\int dy = \int (2x + 1)^3 dx$ $y = \frac{(2x + 1)^4}{(4)(2)} + c$ $y = \frac{1}{8}(2x + 1)^4 + c, \text{ pada / at } \left(\frac{1}{2}, 5\right)$ $5 = \frac{1}{8}\left[2\left(\frac{1}{2}\right) + 1\right]^4 + c$ $5 = 2 + c$ $c = 3$ $\therefore y = \frac{1}{8}(2x + 1)^4 + 3$	1 1 1	
11	(a) Katakan X = peristiwa di mana produk boleh dijual Let X = event that a product can be sold $n = 820, p = \frac{19}{20}, q = \frac{1}{20}$ $\text{Min / Mean} = (820)\left(\frac{19}{20}\right)$ $= 779$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	Sisihan piawai / Standard deviation, $= \sqrt{(820) \left(\frac{19}{20} \right) \left(\frac{1}{20} \right)}$ $= \sqrt{\left(\frac{779}{20} \right)}$ $= 6.241$	1 1	7
	(b) (i) ${}^{25}C_r = {}^{25}C_{r+13}$ $r + r + 13 = 25$ $2r + 13 = 25$ $2r = 12$ $r = 6$	1 1	
	(ii) Bilangan cara / Number of ways = $2 \times {}^4P_4$ $= 48$	1 1	
12	(a) $X \sim N(20, 0.5^2)$ Min / Mean = 20 Varians / Variance = $(0.5)^2 = 0.25$	1	
	(b) (i) $P(Z < m) = P(Z < k)$ $\frac{(-\alpha + 40) - 20}{0.5} = m$ $-\alpha + 40 - 20 = 0.5 m$ $-\alpha + 20 = 0.5 m$ $40 + 2\alpha = m$	1	4
	(ii) $P(Z < k) = 0.2662$ $2[0.5 - P(Z > k)] = 0.2662$ $1 - 2P(Z > k) = 0.2662$ $2P(Z > k) = 0.7338$ $P(Z > k) = 0.3669$ $\frac{\alpha - 20}{0.5} = 0.34$ $\alpha - 20 = 0.17$ $\alpha = 20.17$	1	

Bahagian B

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
13	(a) (i) $6 \ln y = \sqrt{5} \ln x$ $6 \log_e y = \sqrt{5} \log_e x$ $\log_e y^6 = \log_e x^{\sqrt{5}}$ $y^6 = x^{\sqrt{5}}$ $y = \sqrt[6]{x^{\sqrt{5}}}$ $y = \sqrt[12]{x^{\sqrt{5}}}$	1 1	

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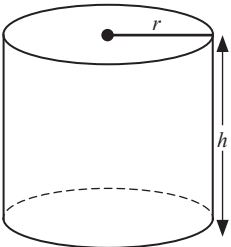
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks																												
15	(c) (i) $gf(x)=\frac{4}{2x-5}$ $g(2x-5)=\frac{4}{2x-5}$ Katakan / Let $2x-5=m$ $2x=m+5$ $x=\frac{m+5}{2}$ $g(m)=\frac{4}{2\left(\frac{m+5}{2}\right)-5}$ $=\frac{4}{m+5-5}$ $=\frac{4}{m}$ $\therefore g(x)=\frac{4}{x}, x\neq 0$	1	8																												
	(ii) $g^2(x)=g\left(\frac{4}{x}\right)$ $=\frac{4}{\frac{4}{x}}$ $=x$	1																													
	$g^3(x)=gg^2(x)$ $=g(x)$ $g^3(x)=\frac{4}{x}$	1.																													
	$g^4(x)=g^2g^2(x)$ $=g^2(x)$ $g^4(x)=x$																														
	$g^{\text{ganjil} / \text{odd}}(x)=\frac{4}{x}$ $g^{\text{genap} / \text{even}}(x)=x$																														
	$4n-3$ adalah ganjil bagi semua integer, n . $4n-3$ is odd for all integer, n .																														
	$\therefore g^{4n-3}(x)=\frac{4}{x}, x\neq 0$	1																													
	(a)			2																											
	<table><tr><td>x</td><td>0</td><td>$\frac{\pi}{6}$</td><td>$\frac{\pi}{3}$</td><td>$\frac{\pi}{2}$</td><td>$\frac{2}{3}\pi$</td><td>$\frac{5}{6}\pi$</td><td>π</td><td>$\frac{7}{6}\pi$</td><td>$\frac{4}{3}\pi$</td><td>$\frac{3}{2}\pi$</td><td>$\frac{5}{3}\pi$</td><td>$\frac{11}{6}\pi$</td><td>2π</td></tr><tr><td>y</td><td>1</td><td>-1.12</td><td>-2</td><td>-1.12</td><td>1</td><td>3.12</td><td>4</td><td>3.12</td><td>1</td><td>-1.12</td><td>-2</td><td>-1.12</td><td>1</td></tr></table>	x		0	$\frac{\pi}{6}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2}{3}\pi$	$\frac{5}{6}\pi$	π	$\frac{7}{6}\pi$	$\frac{4}{3}\pi$	$\frac{3}{2}\pi$	$\frac{5}{3}\pi$	$\frac{11}{6}\pi$	2π	y	1	-1.12	-2	-1.12	1	3.12	4	3.12	1	-1.12	-2	-1.12	1	
	x	0		$\frac{\pi}{6}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2}{3}\pi$	$\frac{5}{6}\pi$	π	$\frac{7}{6}\pi$	$\frac{4}{3}\pi$	$\frac{3}{2}\pi$	$\frac{5}{3}\pi$	$\frac{11}{6}\pi$	2π																
y	1	-1.12	-2	-1.12	1	3.12	4	3.12	1	-1.12	-2	-1.12	1																		

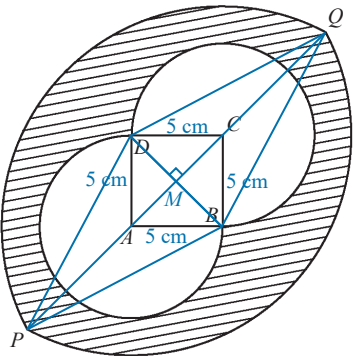
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks								
(b) (c)(ii)	(b) [3 markah] [3 marks] (c) (ii) [1 markah] [1 mark]	4									
(c) (i)	$y + 3 \sin \frac{3}{2}x = 1$ $y = 1 - 3 \sin \frac{3}{2}x$ $3 \sin \frac{3}{2}x = \frac{4x}{\pi} - 2$ $0 = \frac{4x}{\pi} - 2 - 3 \sin \frac{3}{2}x$ $0 = \frac{4x}{\pi} - 3 + 1 - 3 \sin \frac{3}{2}x$ $0 = \frac{4x}{\pi} - 3 + y$ $3 - \frac{4x}{\pi} = y$	1									
(ii)	<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>-1</td><td>-5</td></tr> </table> $x = \frac{19}{30}\pi$	x	0	π	2π	y	3	-1	-5	1	8
x	0	π	2π								
y	3	-1	-5								

KERTAS 2

Bahagian A

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
1	(a) $2p - q - r = 6$ $2p - r - 6 = q \dots \textcircled{1}$ $p + 2q - 4r = 8 \dots \textcircled{2}$ $3p + q - r = 2 \dots \textcircled{3}$ $\textcircled{1} \rightarrow \textcircled{2}; p + 2(2p - r - 6) - 4r = 8$ $p + 4q - 2r - 12 = 0$ $5p - 6r - 20 = 0 \dots \textcircled{4}$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) $\overrightarrow{ED} = -\frac{8}{3}\underline{x} + 4\underline{y}$ $\overrightarrow{ED} = \frac{4}{3}(-2\underline{x} + 3\underline{y})$ $\overrightarrow{ED} = \frac{4}{3}(\overrightarrow{BC})$ $\therefore \overrightarrow{ED} = \frac{4}{3}\overrightarrow{BC}$ $\therefore \overrightarrow{ED} \parallel \overrightarrow{BC}$	1 1	5
3	(a)  $I_{\text{silinder}} / V_{\text{cylinder}} = \frac{125}{4}\pi \text{ m}^3$ $\pi r^2 h = \frac{125}{4}\pi$ $r^2 h = \frac{125}{4}$ $h = \frac{125}{4r^2}$ Jumlah luas permukaan, A Total surface area, A $A = 2\pi r^2 + 2\pi rh$ $= 2\pi r^2 + 2\pi r \left(\frac{125}{4r^2}\right)$ $= 2\pi r^2 + \frac{125\pi}{2r}$	1 1 1	
	(b) $A = 2\pi r^2 + \frac{125\pi}{2r}$ $= 2\pi r^2 + \frac{125}{2}\pi r^{-1}$ $\frac{dA}{dr} = 4\pi r + (-1)\left(\frac{125}{2}\right)\pi r^{-1-1}$ $= 4\pi r - \frac{125}{2}\pi r^{-2}$ Apabila / When $\frac{dA}{dr} = 0$, $4\pi r - \frac{125\pi}{2r^2} = 0$ $4\pi r = \frac{125\pi}{2r^2}$ $8\pi r^3 = 125\pi$ $8r^3 = 125$ $r^3 = \frac{125}{8}$	1	

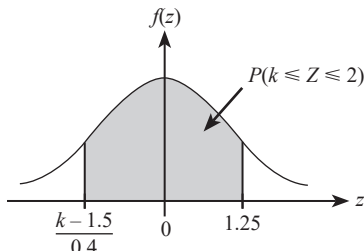
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	$144r_B^2 - 128r_B + 23 = 0$ $(36r_B - 23)(4r_B - 1) = 0$ $36r_B - 23 = 0 \quad , \quad 4r_B - 1 = 0$ $r_B = \frac{23}{36} \quad , \quad r_B = \frac{1}{4}$ $T_{10A} < 0$ $8(r_A)^{10-1} < 0$ $8(r_A)^9 < 0$ $r_A < 0 \dots \textcircled{2}$ Dari / From $\textcircled{1}$ & $\textcircled{2}$, $r_A = 2\left(\frac{23}{36}\right) - 1 \quad , \quad r_A = 2\left(\frac{1}{4}\right) - 1$ $r_A = \frac{5}{18} < 0 \text{ (abaikan / ignore)} \quad , \quad r_A = -\frac{1}{2} < 0$ $S_{4A} = \frac{8\left[1 - \left(-\frac{1}{2}\right)^4\right]}{1 - \left(-\frac{1}{2}\right)}$ $= 5 < S_{4B}$ $S_{4B} = \frac{4\left[1 - \left(\frac{1}{4}\right)^4\right]}{1 - \left(\frac{1}{4}\right)} = 5.3125$ $\therefore$ Pernyataan tersebut adalah palsu. / The statement is false.	1 1 1 1 1 1	8
7	 (a) $PM = MQ = \frac{1}{2}PQ = 11.5 \text{ cm}$ $BM = DM = \frac{1}{2}BD$ $= \frac{1}{2}(\sqrt{5^2 + 5^2})$		

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	$= \frac{1}{2}(5\sqrt{2})$ $= \frac{5\sqrt{2}}{2}$ $\angle PBQ = 2 \times \angle QBM$ $= 2 \tan^{-1}\left(\frac{QM}{BM}\right)$ $= 2 \tan^{-1}\left(\frac{11.5}{\frac{5\sqrt{2}}{2}}\right)$ $= 2(72.91^\circ)$ $= 145.82^\circ$ $= 2.55 \text{ rad}$	 1 1	
(b)	(i) $BQ = \sqrt{MQ^2 + BM^2}$ $= \sqrt{(11.5)^2 + \left(\frac{5\sqrt{2}}{2}\right)^2}$ $= \sqrt{\frac{579}{4}}$ $= 12.0312 \text{ cm}$ Perimeter luar / Outside perimeter = $2AB$ $= 2 \times r\theta$ $= 2(12.0312)(2.55)$ $= 61.3591 \text{ cm}$ (ii) Luas temberang PQ / Area of segment PQ $= \frac{1}{2}r^2\theta - \frac{1}{2}r^2 \sin \theta$ $= \frac{1}{2}(12.0312)^2(2.55) - \frac{1}{2}(12.0312)^2 \sin 145.82^\circ$ $= 184.5560 - 40.6598$ $= 143.8962 \text{ cm}^2$ Luas seluruh rajah / Area of whole diagram = 2×143.8962 $= 287.7924 \text{ cm}^2$ Luas sektor BCD / Area of sector BCD $= \frac{1}{2}(5)^2\left(\frac{3\pi}{2}\right)$ $= 58.9125 \text{ cm}^2$ Luas kawasan berlorek / Area of the shaded region $= \text{Luas seluruh rajah} - \text{Luas sektor } BCD - \text{Luas sektor } BAD$ $= \text{Luas } ABCD$ $= \text{Area of whole diagram} - \text{Area of sector } BCD - \text{Area of sector } BAD$ $= \text{Area of } ABCD$ $= 287.7924 - 58.9125 - 58.9125 - (5 \times 5)$ $= 144.9674 \text{ cm}^2$	 1 1 1 1 1 1	

9

Bahagian B

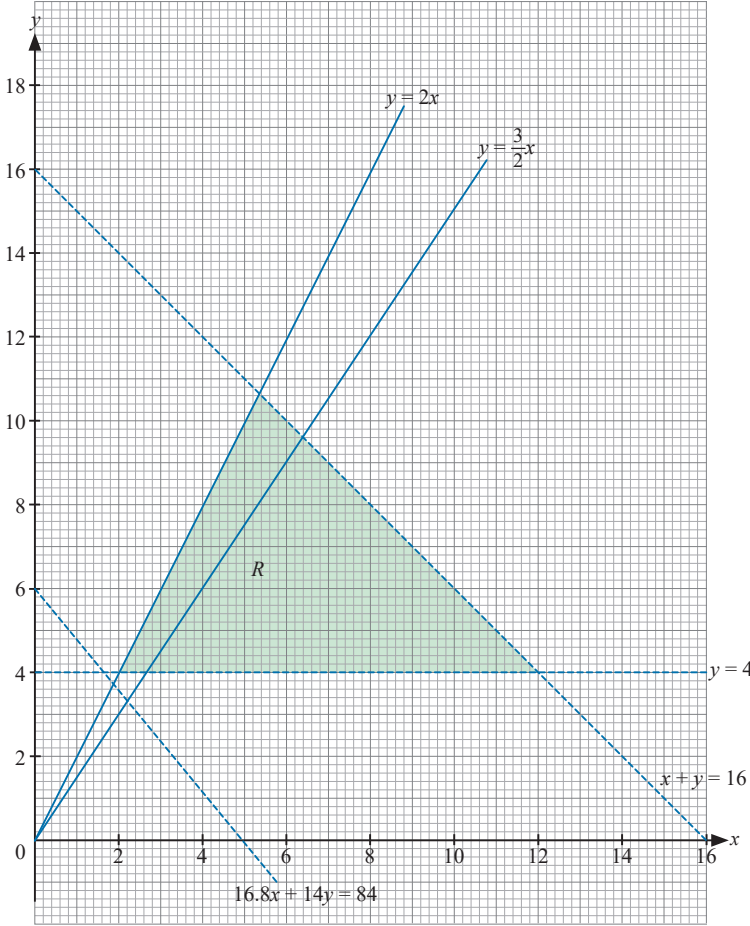
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
8	(a) $y = x^2 - 9 \dots \textcircled{1}$ $\frac{x}{5} - \frac{y}{10} = 1$ $2x - y = 10$ $2x - 10 = y \dots \textcircled{2}$ $\textcircled{1} = \textcircled{2}, \quad x^2 - 9 = 2x - 10$ $x^2 - 2x - 9 + 10 = 0$ $x^2 - 2x + 1 = 0$ $(x - 1)(x - 1) = 0$ $x - 1 = 0$ $x = 1$ $\therefore p = 1$	1	
	(b) $y = x^2 - 9$ $y = (x + 3)(x - 3)$ Apabila / When $y = 0$, $(x + 3)(x - 3) = 0$ $x + 3 = 0, \quad x - 3 = 0$ $x = -3, \quad x = 3$ Luas / Area = $\left \int_1^3 (x^2 - 9) dx \right$ $= \left \left[\frac{1}{3}x^3 - 9x \right]_1^3 \right $ $= \left \left[\frac{1}{3}(3)^3 - 9(3) \right] - \left[\frac{1}{3}(1)^3 - 9(1) \right] \right $ $= \left -18 - \left(-\frac{26}{3} \right) \right $ $= \left -\frac{28}{3} \right $ $= \frac{28}{3} \text{ unit}^2$	1 1 1 1	
	(c) Dari / From $\textcircled{2}$, $y = 2x - 10$ apabila / when $x = 0$ $y = 2(0) - 10$ $y = -10$ $y = 2x - 10$ apabila / when $y = 0$ $0 = 2x - 10$ $-2x = -10$ $x = 5$ Isi padu kon / Volume of cone = $\frac{1}{3}\pi r^2 h$ $= \frac{1}{3}\pi(5)^2(10)$ $= 83\frac{1}{3}\pi \text{ 8 unit}^3$ Dari / From $\textcircled{1}$, $y = x^2 - 9$ apabila / when $x = 0$ $y = (0)^2 - 9$ $y = -9$	1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	Luas lengkung / Volume of the curve $= \pi \int_{-9}^0 x^2 dy = \pi \int_{-9}^0 (y + 9) dy$ $= \pi \left[\frac{1}{2} y^2 + 9y \right]_{-9}^0$ $= \pi \left[\frac{1}{2} (0)^2 + 9(0) \right] - \pi \left[\frac{1}{2} (-9)^2 + 9(-9) \right]$ $= 0 - \left(-\frac{81}{2} \pi \right)$ $= 40\frac{1}{2} \pi \text{ unit}^3$ $I_{\text{lorekan dikisar } 180^\circ} = \frac{1}{2} (\text{Isi padu kon} - \text{Isi padu lengkung})$ $V_{\text{shaded revolved } 180^\circ} = \frac{1}{2} (\text{Volume of cone} - \text{Volume of curve})$ $= \frac{1}{2} \left(83\frac{1}{3} \pi - 40\frac{1}{2} \pi \right)$ $= \frac{1}{2} \left(42\frac{5}{6} \pi \right) \text{ unit}^3$ $= 21\frac{5}{12} \pi \text{ unit}^3$	1 1 1	10
9	(a) Katakan X = Murid tidak menaiki bas <i>Let X = Student not go by bus</i> $n = 8, q = 0.75, p = 1 - 0.75$ $= 0.25$ $P(x \leq 2) = P(X = 0) + P(X = 1) + P(X = 2)$ $= {}^8C_0 (0.25)^0 (0.75)^8 + {}^8C_1 (0.25)^1 (0.75)^7 + {}^8C_2 (0.25)^2 (0.75)^6$ $= 0.1001 + 0.2670 + 0.3115$ $= 0.6786$ (b) (i) $X \sim N(1.5, 0.4^2)$ $P(X > 2) = P\left(Z > \frac{2 - 1.5}{0.4}\right)$ $= P(Z > 1.25)$ $= 0.1056$ (ii)  $P(k \leq X \leq 2) = 72.84\%$ $P\left(\frac{k - 1.5}{0.4} \leq Z \leq \frac{2 - 1.5}{0.4}\right) = 0.7284$ $P\left(\frac{k - 1.25}{0.4} \leq Z \leq 1.25\right) = 0.7284$ $P\left(Z \geq \frac{k - 1.5}{0.4}\right) - P(Z \geq 1.25) = 0.7284$	1 1 1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks														
	(ii) Pintasan paksi-y / Intersection of y-axis, $x = 0$ $8x - 32y - 96 = 0$ $8(0) - 32y - 96 = 0$ $-32y = 96$ $y = -3$ $\therefore E(0, -3)$ $m_{BA} = \frac{6 - 0}{2 - (-1)} = 2$ $m_{CE} = \frac{-3 - 2}{0 - 3} = \frac{5}{3}$ $m_{BA} \neq m_{CE}$ $\therefore BA$ adalah tidak selari dengan CE. <i>BA is not parallel to CE.</i>	1 1 1 1	10														
11	(a) <table><tr><td>$\log_{10}x$</td><td>0.3802</td><td>0.4997</td><td>0.5999</td><td>0.8000</td><td>1</td><td>1.2601</td></tr><tr><td>$\log_{10}y$</td><td>0.1004</td><td>0.2014</td><td>0.4014</td><td>0.5999</td><td>0.9499</td><td>1.3002</td></tr></table> (b)	$\log_{10}x$	0.3802	0.4997	0.5999	0.8000	1	1.2601	$\log_{10}y$	0.1004	0.2014	0.4014	0.5999	0.9499	1.3002	2 3	
$\log_{10}x$	0.3802	0.4997	0.5999	0.8000	1	1.2601											
$\log_{10}y$	0.1004	0.2014	0.4014	0.5999	0.9499	1.3002											

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) $\frac{\sin \angle AGE}{18.21} = \frac{\sin 15^\circ}{5}$ $\sin \angle AGE = 0.9426$ $\angle AGE = \sin^{-1}(0.9426) \quad \angle AGE = 70.49^\circ$ $\angle GEA = 180^\circ - 15^\circ - 70.49^\circ$ $= 94.51^\circ$ $\frac{AG}{\sin 94.51^\circ} = \frac{5}{\sin 15^\circ}$ $AG = \frac{5 \sin 94.51^\circ}{\sin 15^\circ}$ $AG = 19.26 \text{ cm}$	1 1 1 1	10
13	(a) (i) $t = 5 \text{ s}$ (ii) Bergerak ke kiri / Moves to left: $v < 0$ $0 < t < 5$	1 1	
	(b) (i) $v \text{ (m s}^{-1}\text{)}$ $v = at^2 + bt + c$ pada / at $(0, 0)$ $0 = a(0)^2 + b(0) + c$ $0 = c$ $v = at^2 + bt + c$ pada / at $(5, 0)$ $0 = a(5)^2 + b(5) + c$ $0 = 25a + 5b$ $-25a = 5b$ $-5a = b \dots \textcircled{1}$ $v = at^2 + bt + c$ pada / at $(6, 12)$ $12 = a(6)^2 + b(6)$ $12 = 36a + 6(-5a)$ $12 = 36a - 30a$ $12 = 6a$ $2 = a$ Dari / From $\textcircled{1}$, $b = -5(2)$ $= -10$ $\therefore v = 2t^2 - 10$ (Tertunjuk / Shown)	1 1 1	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks						
	(ii) $v = 2t^2 - 10$ $a = \frac{dV}{dt}$ $a = 4t - 10$ apabila / when $t = 2$ s $a = 4(2) - 10$ $a = -2 \text{ m s}^{-2}$ (iii) Halaju maksimum / Maximum velocity: $a = 0$ $4t - 10 = 0$ $4t = 10$ $t = \frac{5}{2}$ Jarak / Distance $= \left \int_{\frac{5}{2}}^5 (2t^2 - 10t) \, dt \right + \int_5^6 (2t^2 - 10t) \, dt$ $= \left \left[\frac{2}{3}t^3 - 5t^2 \right]_{\frac{5}{2}}^5 \right + \left[\frac{2}{3}t^3 - 5t^2 \right]_5^6$ $= \left \left[\frac{2}{3}(5)^3 - 5(5)^2 \right] - \left[\frac{2}{3}\left(\frac{5}{2}\right)^3 - 5\left(\frac{5}{2}\right)^2 \right] \right + \left\{ \left[\frac{2}{3}(6)^3 - 5(6)^2 \right] - \left[\frac{2}{3}(5)^3 - 5(5)^2 \right] \right\}$ $= \left -\frac{125}{3} - \left(-\frac{125}{6}\right) \right + \left[-36 - \left(-\frac{125}{3}\right) \right]$ $= \left -\frac{125}{6} \right + \frac{17}{3}$ $= \frac{125}{6} + \frac{17}{3}$ $= 26\frac{1}{2} \text{ m}$	1 1 1 1 1	10						
14	(a) $p = 16$ $q = 4$	1							
	(b) $y \leq 2x$	1							
	<table><tr><td>x</td><td>0</td><td>4</td></tr><tr><td>y</td><td>0</td><td>8</td></tr></table>	x	0	4	y	0	8		
x	0	4							
y	0	8							

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks																		
	 (c) (i) Kaedah 1 = Kaedah algebra Method 1 = Algebraic method <table border="1" data-bbox="284 1232 396 1389"><tr><td>y</td><td>:</td><td>x</td></tr><tr><td>3</td><td>:</td><td>2</td></tr><tr><td>6</td><td>:</td><td>4</td></tr><tr><td>9</td><td>:</td><td>6</td></tr></table> } Koordinat (4, 6) dan (9, 6) berada dalam rantau R. } The coordinates (4, 6) and (9, 6) are in R region. Kaedah 2 = Kaedah graf Method 2 = Graphical method $\frac{y}{x} = \frac{3}{2}$ $y = \frac{3}{2}x$ <table border="1" data-bbox="284 1642 512 1732"><tr><td>x</td><td>0</td><td>6</td></tr><tr><td>y</td><td>0</td><td>9</td></tr></table> $\therefore$ Bilangan yang mungkin bagi anak patung Mal ialah 4 dan 6. Possible number of Mal's dolls are 4 and 6.	y	:	x	3	:	2	6	:	4	9	:	6	x	0	6	y	0	9	2	
y	:	x																			
3	:	2																			
6	:	4																			
9	:	6																			
x	0	6																			
y	0	9																			
		1																			
		1																			

KERTAS MODEL SIJIL PELAJARAN MALAYSIA 2024

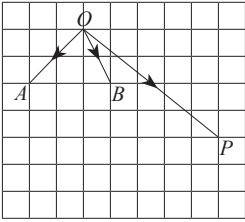
KERTAS 1

Bahagian A

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah 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	Jumlah Markah 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	
	(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	6
5	(a) $x \log_{27} p = \log_3 p$ $\log_{27} p^x = \log_3 p$ $\frac{\log_3 p^x}{\log_3 27} = \log_3 p$ $\frac{\log_3 p^x}{\log_3 3^3} = \log_3 p$ $\frac{\log_3 p^x}{3 \log_3 3} = \log_3 p \dots$ $\frac{\log_3 p^x}{3 \log_3 3} = \log_3 p$ $\log_3 p^x = 3 \log_3 p$ $p^x = p^3$ $x = 3$	1 1 1	6
	(b) $3^{2h - 4m} = 5 + 3^{3(2h)}$ $\frac{3^{2h}}{3^{4m}} = 5 + (3^{2h})^3$ $\frac{k}{p} = 5 + k^3 \dots$ $\frac{k}{5 + k^3} = p$	1 1 1	

Bahagian B

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah 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	
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	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
15	(a) $\frac{T_3}{T_2} = \frac{\frac{m^5}{27}}{\frac{m^3}{3}} = 1$ $\frac{m^2}{9} = 1$ $m^2 = 9$ $m = 3, m = -3$	1 1	
	(b) (i) $T_2: ar^{2-1} = \frac{m^3}{3}$ $ar = \frac{m^3}{3}$ $T_3: ar^{3-1} = \frac{m^5}{27}$ $ar^2 = \frac{m^5}{27}$ $\frac{ar^2}{ar} = \frac{\frac{m^5}{27}}{\frac{m^3}{3}}$ $r = \left(\frac{m^5}{27}\right) \times \left(\frac{3}{m^3}\right)$ $r = \frac{m^2}{9}$ $r = \frac{(4)^2}{9}$ $r = \frac{16}{9}$ $ar = \frac{64}{3}$ $a\left(\frac{16}{9}\right) = \frac{64}{3}$ $a = \frac{64}{3} \div \frac{16}{9}$ $a = \frac{64}{3} \times \frac{9}{16}$ $a = 12$	1 1 1	
	(ii) $S_{2 \rightarrow 5} = S_5 - S_1$ $= \frac{12\left[\left(\frac{16}{9}\right)^5 - 1\right]}{\left(\frac{16}{9}\right) - 1} - 12$ $= \frac{565\,444}{2\,187} - 12$ $= \frac{539\,200}{2\,187}$ atau / or $S_{2 \rightarrow 5} = 246.5478$	1 1 1	
			8

KERTAS 2
Bahagian A

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
1	Diberi (6, -4) dan kecerunan $\frac{1}{2}$. Given (6, -4) and gradient $\frac{1}{2}$.		
	$-4 = m(6) + \frac{1}{2}$	1	
	$6m = -\frac{9}{2}$		
	$m = -\frac{3}{4}$		
	Maka / Thus, $y = -\frac{3}{4}x + \frac{1}{2}$①	1	
	Ganti ① ke dalam / Substitute ① into $x^2 + xy - 6 = 0$:		
	$x^2 + x\left(-\frac{3}{4}x + \frac{1}{2}\right) - 6 = 0$	1	
	$x^2 - \frac{3}{4}x^2 + \frac{1}{2}x - 6 = 0$		
	$\frac{1}{4}x^2 + \frac{1}{2}x - 6 = 0$		
	$\frac{1}{4}(x+6)(x-4) = 0$		
	$x = -6, x = 4$	1	
	Pada / At $x = -6$,		
	$y = -\frac{3}{4}(-6) + \frac{1}{2}$		
	$= 5$		
	Pada / At $x = 4$,		
	$y = -\frac{3}{4}(4) + \frac{1}{2}$		
	$= -\frac{5}{2}$		
	Maka, $A(-6, 5)$ dan $B\left(4, -\frac{5}{2}\right)$.		
	Thus, $A(-6, 5)$ and $B\left(4, -\frac{5}{2}\right)$.	2	6
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 / Thus, $a = 5$	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	

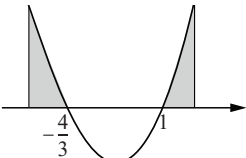
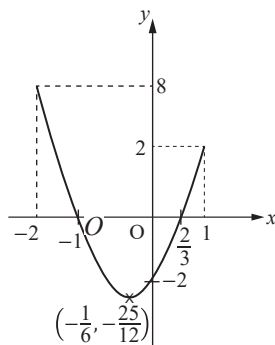
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
4	(a) (i) $\vec{QT} = \vec{QO} + \vec{OT}$ $= -8\vec{a} + 2\vec{b}$	1	8
	(ii) $\vec{PS} = \vec{PO} + \vec{OS}$ $= -4\vec{a} + 5\vec{b}$	1	
	(b) (i) $\vec{OR} = \vec{OQ} + \vec{QR}$ $= 8\vec{a} + m(-8\vec{a} + 2\vec{b})$ $= (8 - 8m)\vec{a} + 2m\vec{b}$	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	
5	(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) $\theta = \frac{1}{5}\pi$ Perimeter $= 2r + r\left(\frac{1}{5}\pi\right)$, Luas / Area $= \frac{1}{2}r^2\left(\frac{1}{5}\pi\right)$	1	8
	$2r + r\left(\frac{1}{5}\pi\right) = \frac{1}{2}r^2\left(\frac{1}{5}\pi\right)$	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	
5	Jisim sepotong kek / Mass per slice of cake $= 263.79 \div 0.916$ $= 287.98 \text{ g}$	1	8
	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	
		1	

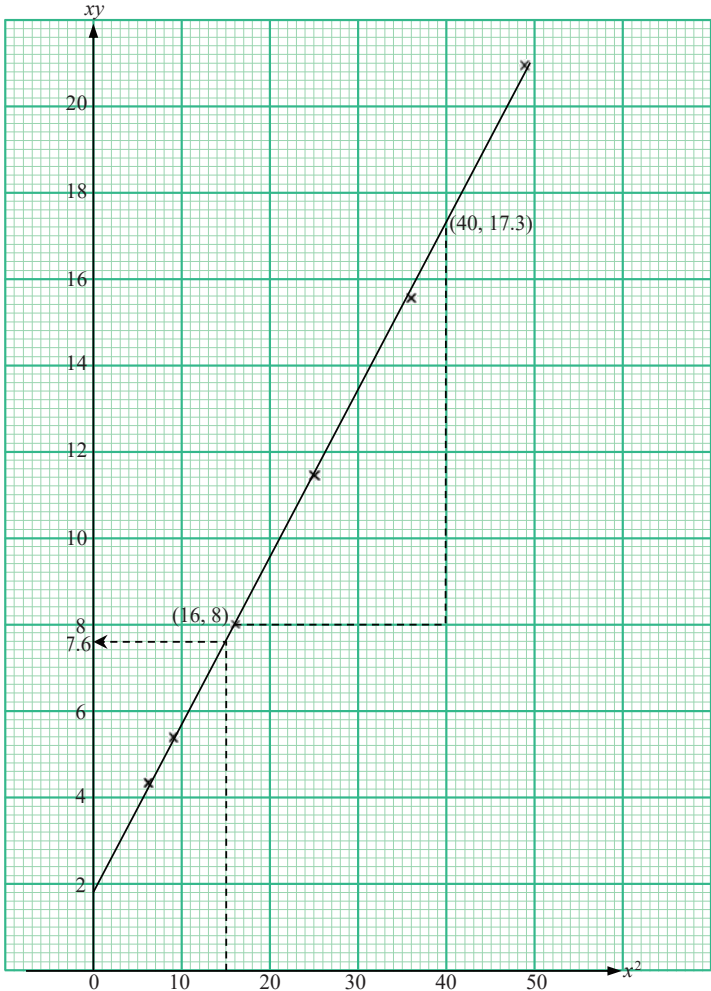
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
6	(a) $T_1 = \frac{1}{2}(b)(h)$ $= \frac{bh}{2}$ $T_2 = \frac{1}{2}(b)(h+1)$ $= \frac{b(h+1)}{2}$ $= \frac{bh+b}{2}$ $T_3 = \frac{1}{2}(b)(h+2)$ $= \frac{b(h+2)}{2}$ $= \frac{bh+2b}{2}$ $T_3 - T_2 = T_2 - T_1$ $\frac{bh+2b}{2} - \frac{bh+b}{2} = \frac{bh+b}{2} - \frac{bh}{2}$ $\frac{b}{2} = \frac{b}{2}$ 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	Jumlah Markah 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	

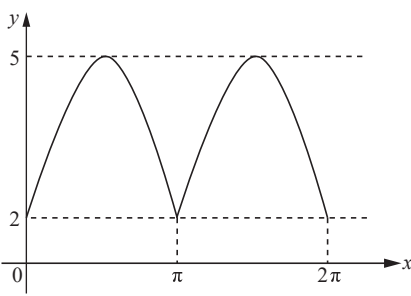
Bahagian B

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah 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	Jumlah Markah 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	Jumlah Markah 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											

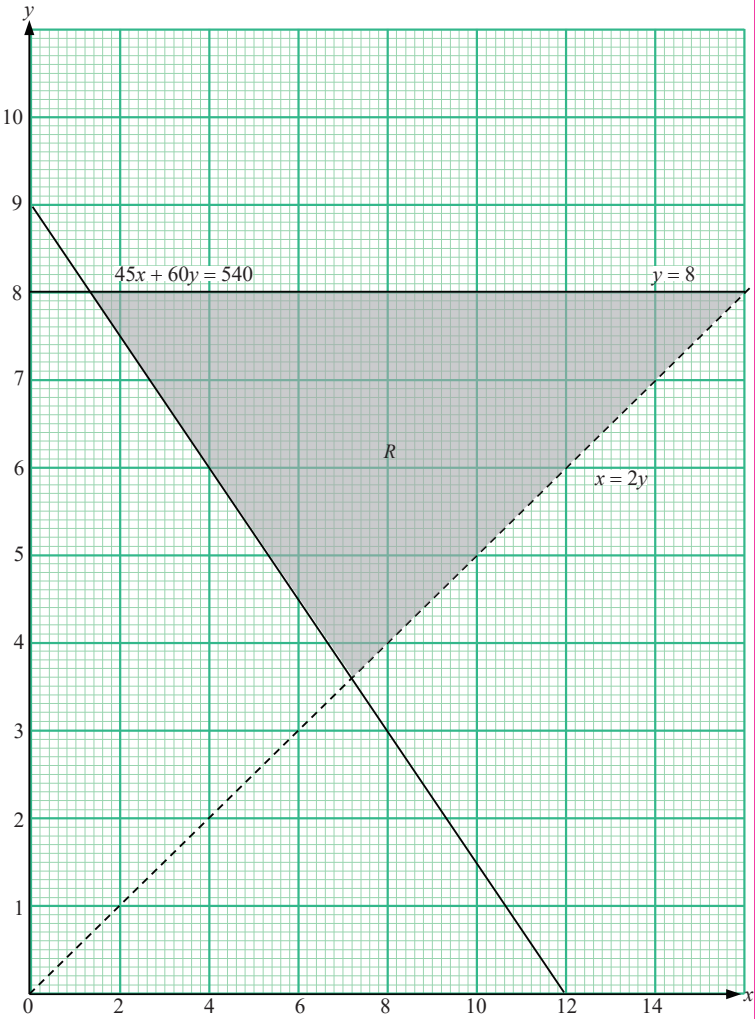
No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) (i) $xy = \frac{b}{a}x^2 + a$ Apabila / When $x^2 = 15$, $xy = 7.6$ $y = \frac{7.6}{\sqrt{15}}$ $y = 1.962$ (ii) $a = 1.9$ $m: \frac{b}{a} = \frac{17.3 - 8}{40 - 16}$ $\frac{b}{1.9} = \frac{17.3 - 8}{40 - 16}$ $\frac{b}{1.9} = \frac{31}{80}$ $b = 0.7363$	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), $12 = \frac{2(3)^2}{2} + c$ $c = 3$ $\therefore y = x^2 + 3$ (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 $\frac{1}{2}(3)(3 + 12) - \int_0^3 x^2 + 3 dx$ $= \frac{45}{2} - \left[\frac{x^3}{3} + 3x \right]_0^3$ $= \frac{45}{2} - \left[\left(\frac{3^3}{3} + 3(3) \right) - \left(\frac{0^3}{3} + 3(0) \right) \right]$ $= \frac{9}{2}$ (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 1 1 1 1 1 1 1	10

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

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah 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) $I_{\frac{2018}{2016}} = \frac{120(2) + 100(3) + 95(3) + 100(2)}{10}$ $= 102.5$	1																	
	<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>	$P_0 \backslash P_1$		2013	2016	2018	2013		122.2	x	2016		100	102.5	2018				
	$P_0 \backslash P_1$	2013		2016	2018														
2013		122.2	x																
2016		100	102.5																
2018																			
$\frac{122.3}{100} = \frac{x}{102.5}$ $x = 125.87$	1																		
	(d) $\frac{P_{2018}}{20} \times 100 = 125.87$ $P_{2018} = \text{RM}25.17$	1 1	10																
14	(a) $45x + 60y \geq 540$ $x < 2y$ $y \leq 8$	1 1 1																	

No.	Skema Pemarkahan Marking Scheme	Markah Marks	Jumlah Markah Total Marks
	(b) – Semua garis lurus dilukis dengan betul. <i>All straight lines are drawn correctly.</i> – Kawasan berlorek yang betul. <i>Correct shaded region.</i> 	1	
	(c) (i) $4 < y \leq 8$ (ii) Titik maksimum / <i>Maximum point</i> = (15, 8) Bilangan maksimum bilangan kopi = 23×18 <i>Maximum number of coffee drink</i> = 414	2	

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