Yakin
Pustaka Yakin Pelajar Sdn. Bhd.

KERTAS SOALAN PEPERIKSAAN SEBENAR SPM 2021-2022

FORMAT TERKINI

+2 SET KERTAS MODEL FORMAT INSTRUMEN SPM TERKINI

MATEMATIK TAMBAHAN

Dwibahasa

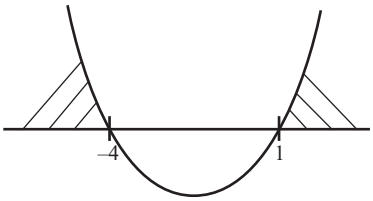
SIJIL PELAJARAN MALAYSIA 2021

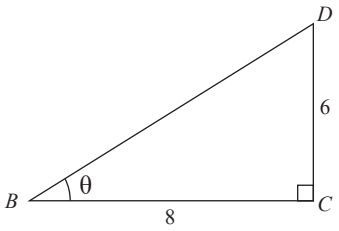
KERTAS 1

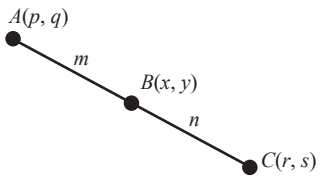
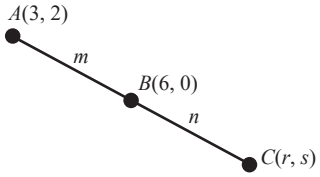
Bahagian A

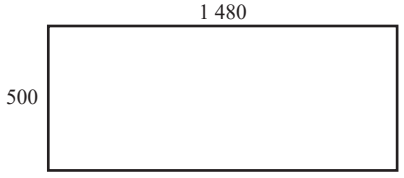
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
1	$\angle AOB$ major $= 2\pi - \frac{\pi}{3}$ $= \frac{5}{3}\pi$ Luas / *Area* $= \frac{1}{2}(2)^2\left(\frac{5}{3}\pi\right)$ $= \frac{10}{3}\pi$ cm^2	 1 1	 2
2	$m = \frac{7-1}{5-2} = 2$ $\frac{c-1}{0-2} = 2$ $c - 1 = -4$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

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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
5	(*a*) $f(x) > 0$ $x^2 + 3x - 4 > 0$ $(x + 4)(x - 1) > 0$  $x < -4, x > 1$	1 1	
	(*b*) (i) $px + q - (x^2 + 3x - 4) = 0$ $-x^2 + (p - 3)x + q + 4 = 0$ $x^2 - (p - 3)x - q - 4 = 0$ $\alpha + \beta = p - 3$ $\alpha\beta = -q - 4$	 1 1	
	(ii) $x^2 + rx + r - 10 = 0$ $\frac{2}{\alpha} + \frac{2}{\beta} = -r$ dan / *and* $\left(\frac{2}{\alpha}\right)\left(\frac{2}{\beta}\right) = r - 10$ $\frac{2}{\alpha} + \frac{2}{\beta} = -r$ $2\left(\frac{\beta + \alpha}{\alpha\beta}\right) = -r$ $\frac{2(p - 3)}{-q - 4} = -r$ $r = \frac{2(p - 3)}{q + 4}$ $\left(\frac{2}{\alpha}\right)\left(\frac{2}{\beta}\right) = r - 10$ $\frac{4}{\alpha\beta} = r - 10$ $\frac{4}{-q - 4} = r - 10$ $r = \frac{-4}{q + 4} + 10$ $\frac{2(p - 3)}{q + 4} = \frac{-4}{q + 4} + 10$ $2(p - 3) = -4 + 10(q + 4)$ $2(p - 3) = 10q + 36$ $p - 3 = 5q + 18$ $p = 5q + 21$	 1 1 1	7

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

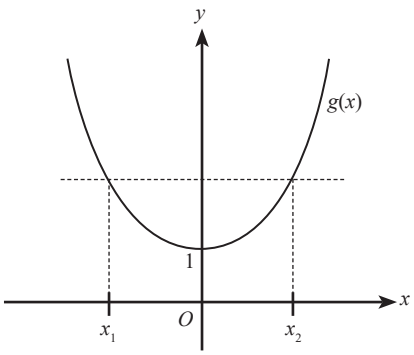
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
8	(*a*)  $\frac{q-y}{y-s}=\frac{m}{n}$ $nq-ny=my-ms$ $ms+nq=(m+n)y$ $y=\frac{ms+nq}{m+n}$ $\frac{x-p}{r-x}=\frac{m}{n}$ $nx-np=mr-mx$ $(m+n)x=mr+np$ $x=\frac{mr+np}{m+n}$ $(x,y)=\left(\frac{mr+np}{m+n},\frac{ms+nq}{m+n}\right)$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

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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	$V_1 = \pi r^2 h$ $= \pi\left(\frac{740}{\pi}\right)^2 (500)$ $= \frac{273\,800\,000}{\pi}\ \text{mm}^3$ $= \frac{2.738 \times 10^8}{\pi}\ \text{mm}^3$ **Cara 2 / *Method* 2** 500 1 480 $2\pi r = 500$ $r = \frac{500}{2\pi}$ $= \frac{250}{\pi}$ $V_2 = \pi r^2 h$ $= \pi\left(\frac{250}{\pi}\right)^2 (1\,480)$ $= \frac{92\,500\,000}{\pi}\ \text{mm}^3$ $= \frac{9.25 \times 10^8}{\pi}\ \text{mm}^3$ $V_1 = \pi\left(\frac{740}{\pi}\right)^2 (500)$ dan / *and* $V_2 = \pi\left(\frac{250}{\pi}\right)^2 (1\,480)$ Cara 1 membentuk silinder dengan isi padu maksimum: *Method* 1 *forms a cylinder with maximum volume*: $V_1 = \frac{2.738 \times 10^8}{\pi}\ \text{mm}^3$ dan / *and* $r = \frac{740}{\pi}$	1 1	**8**
11	(*a*) (i) $6! = 720$ (ii) $\frac{1\text{ kad / } card}{3\text{ kad / } cards}$ atau / *or* $\frac{2\text{ kad / } cards}{2\text{ kad / } cards}$ $\frac{1\text{ kad / } card}{3\text{ kad / } cards} = 4 \times 2! \times 2! \times 3$ $= 48$ cara / *ways* $\frac{2\text{ kad / } cards}{2\text{ kad / } cards}$ $: \frac{15 \text{ atau / } or \text{ } 17 \text{ atau / } or \text{ } 19}{26 \text{ atau / } or \text{ } 62} = 6$ cara / *ways* $: \frac{51 \text{ atau / } or \text{ } 57 \text{ atau / } or \text{ } 59}{62} = 3$ cara / *ways*	1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	$: \dfrac{26}{51 \text{ atau / } or \text{ } 57 \text{ atau / } or \text{ } 59} + \dfrac{26}{71 \text{ atau / } or \text{ } 75 \text{ atau / } or \text{ } 79} +$ $\dfrac{26}{91 \text{ atau / } or \text{ } 95 \text{ atau / } or \text{ } 97} = 9$ cara / *ways* $: \dfrac{62}{71 \text{ atau / } or \text{ } 75 \text{ atau / } or \text{ } 79} = 3$ cara / *ways* $: \dfrac{62}{91 \text{ atau / } or \text{ } 95 \text{ atau / } or \text{ } 97} = 3$ cara / *ways* ATAU / *OR* ${}^1P_1 \times {}^1P_1 \times {}^3P_1 \times {}^3P_1$ atau / *or* ${}^1P_1 \times {}^1P_1 \times {}^2P_1 \times {}^3P_1$ atau / *or* ${}^1P_1 \times {}^3P_1 \times {}^1P_1 \times {}^1P_1$ atau / *or* ${}^2P_1 \times {}^3P_1 \times {}^1P_1 \times {}^1P_1$ atau / *or* ${}^4P_2 \times 1 \times 1$ Jumlah bilangan cara / *Total number of ways*: $= 48 + 6 + 3 + 9 + 3 + 3$ $= 72$	2 1	
	(*b*) (i) $n = 0$ (ii) ${}^pC_3 = 26(p-2)$ $\dfrac{p!}{(p-3)!3!} = 26(p-2)$ $\dfrac{p(p-1)(p-2)(p-3)!}{(p-3)!(6)} = 26(p-2)$ $p(p-1) = 26(6)$ $p(p-1) = 13(12)$ $p = 13$	1 1 1	**7**
12	(*a*) $P(X=2) + P(X=3) = 1 - \dfrac{81}{128} - \dfrac{1}{64}$ $= \dfrac{45}{128}$	1	
	(*b*) ${}^5C_2(p)^2(q)^3 + {}^5C_3(p)^3(q)^2 = \dfrac{45}{128}$ $10p^2q^3 + 10p^3q^2 = \dfrac{45}{128}$ $10p^2q^2(q+p) = \dfrac{45}{128}$ $p^2q^2(q+p) = \dfrac{9}{256}$ $p^2q^2(1) = \dfrac{9}{256}$ $pq = \dfrac{3}{16}$ $p = \dfrac{3}{16q}$ Tertunjuk / *Shown*	1 1 1	**4**

Bahagian B

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

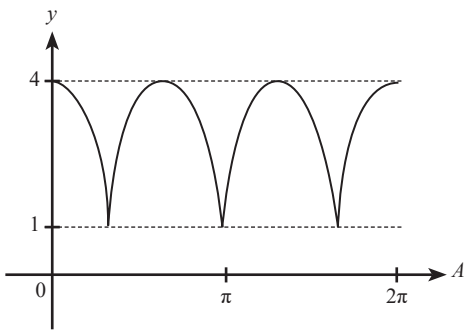
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) $\frac{(5+\sqrt{7})t}{2} = 9(\sqrt{7}-1)$ $(5+\sqrt{7})t = 18\sqrt{7}-18$ $t = \frac{18\sqrt{7}-18}{5+\sqrt{7}} \times \frac{5-\sqrt{7}}{5-\sqrt{7}}$ $= \frac{90\sqrt{7}-126-90+18\sqrt{7}}{25-7}$ $= \frac{108\sqrt{7}-216}{18}$ $= 6\sqrt{7}-12$	1 1 1 1	**8**
15	(*a*) $\sin x = t$ kos / cos $x = \pm\sqrt{1-t^2}$ $0 < x < 90°$ kos / cos $x = \sqrt{1-t^2}$ $\sin 2x = 2t\sqrt{1-t^2}$	 1 1	
	(*b*) $2\,\text{kos}^2 / \cos^2\left(\frac{\theta}{2}\right) - 1 = k$ kos / cos $\left(\frac{\theta}{2}\right) = \pm\sqrt{\frac{1+k}{2}}$ $270° < \theta < 360°$ $135° < \frac{\theta}{2} < 180°$ kos / cos $\left(\frac{\theta}{2}\right) < 0$ kos / cos $\left(\frac{\theta}{2}\right) = -\sqrt{\frac{1+k}{2}}$	1 1	
	(*c*) $\tan 45° = \frac{2\tan 22.5°}{1-\tan^2 22.5°}$ Biarkan / *Let* $\tan 22.5° = t$ $1 = \frac{2t}{1-t^2}$ $1-t^2 = 2t$ $t^2+2t-1=0$ $t = \frac{-2\pm\sqrt{2^2-4(1)(-1)}}{2(1)}$ $= \frac{-2\pm\sqrt{8}}{2}$ $t = \frac{-2+\sqrt{8}}{2}$ dan / *and* $t = \frac{-2-\sqrt{8}}{2}$ $\tan 22.5° > 0$ $\tan 22.5° = \frac{-2+2\sqrt{2}}{2}$ $= \sqrt{2}-1$	1 1 1 1	**8**

KERTAS 2

Bahagian B

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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *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	
	(*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	**7**
4	(*a*) $f(x) = (x - 3)^2 + k$ $f(0) = 5$ $(0 - 3)^2 + k = 5$ $9 + k = 5$ $k = -4$	 1 1	
	(*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. $g(1) = 0$ $-3(1)^2 + (m - 4)(1) - 15 = 0$ $-3 + m - 4 - 15 = 0$ $m - 22 = 0$ $m = 22$ (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 1	**7**

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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) $\overrightarrow{BP} = k\overrightarrow{BY}$ $\overrightarrow{OP} = \lambda\overrightarrow{OX}$ $\overrightarrow{BP} = \overrightarrow{BO} + \overrightarrow{OP}$ $k\overrightarrow{BY} = \left(\overrightarrow{BA} + \overrightarrow{AO}\right) + \lambda(4\underline{a} + \underline{b})$ $k(-\underline{a} - 3\underline{b}) = (-3\underline{b} - 4\underline{a}) + \lambda(4\underline{a} + \underline{b})$ $-k\underline{a} - 3k\underline{b} = (-4 + 4\lambda)\underline{a} + (-3 + \lambda)\underline{b}$ $-4 + 4\lambda = -k$ ..... ① $-3 + \lambda = -3k$ ..... ② $\lambda = 3 - 3k$ ..... ③ Gantikan ③ ke dalam ① *Substitute* ③ *into* ① $-4 + 4(3 - 3k) = -k$ $-4 + 12 - 12k = -k$ $k = \frac{8}{11}$ $\overrightarrow{BP} = \frac{8}{11}\overrightarrow{BY}$ $BP : PY = 8 : 3$	1 1 1 1 1	**8**
7	(*a*) $\frac{dy}{dx} = 2x - 2$ $y = \int(2x - 2)\,dx$ $= \frac{2x^2}{2} - 2x + c$ $x = -2, y = -7$ $-7 = (-2)^2 - 2(-2) + c$ $c = -15$ $y = x^2 - 2x - 15$	 1 1 1	
	(*b*) $y = (x + 1)^2 - 2(x + 1) - 15$ $y = x^2 + 2x + 1 - 2x - 2 - 15$ $y = x^2 - 16$ $x^2 = y + 16$ $V = \pi\int_{-16}^{0}(y + 16)\,dy$ $= \pi\left[\frac{y^2}{2} + 16y\right]_{-16}^{0}$ $= \pi\left[\frac{0^2}{2} + 16(0)\right] - \pi\left[\frac{(-16)^2}{2} + 16(-16)\right]$ $= 128\pi$	1 1 1 1	**7**

Bahagian B

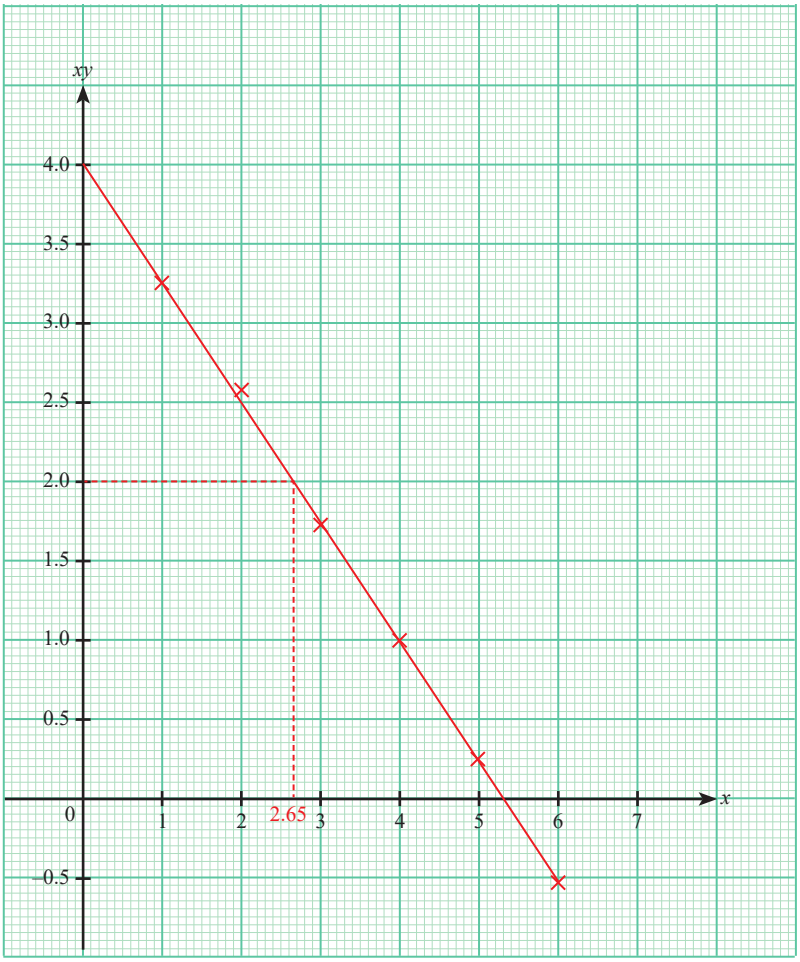
8	(*a*) (i) $A = (26 - 2x)(x)$ $= 26x - 2x^2$ (ii) $\frac{dA}{dx} = 0$ $26 - 4x = 0$ $x = 6.5$ cm $A_{\text{maksimum / } maximum} = 26(6.5) - 2(6.5)^2$ $= 84.5$ cm^2	1 1 1 1	

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

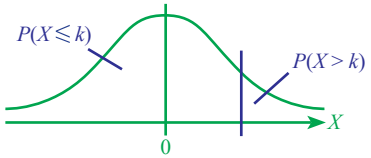
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) (i) $m_{PA} = \frac{y-2}{x-3}$, $m_{PB} = \frac{y-(-8)}{x-(-1)}$	1	
	$\left(\frac{y-2}{x-3}\right)\left(\frac{y-(-8)}{x-(-1)}\right) = -1$	1	
	$y^2 + 8y - 2y - 16 = -(x^2 + x - 3x - 3)$		
	$x^2 + y^2 - 2x + 6y - 19 = 0$	1	
	(ii) $x = 5, y = -2$		
	$5^2 + (-2)^2 - 2(5) + 6(-2) - 19 = -12$	1	
	$-12 \neq 0$, maka lokus P tidak melalui C		
	$-12 \neq 0$, *therefore locus P does not pass through point C*	1	**10**
10	(*a*)		

x	1	2	3	4	5	6
xy	3.25	2.56	1.74	1.00	0.25	–0.54

1



3

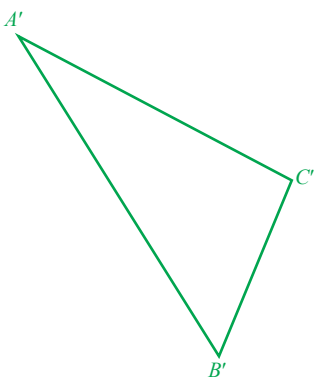
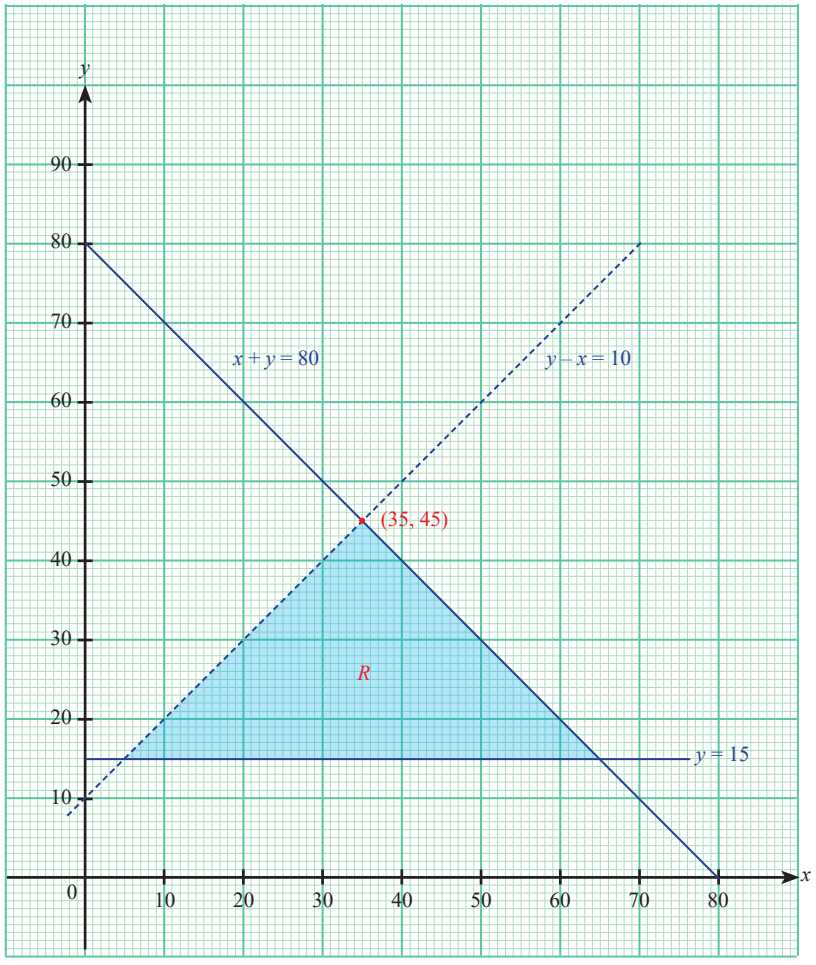
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) (i) $y^2 = \frac{4}{x^2}$ $x^2 y^2 = 4$ $(xy)^2 = 4$ $xy = 2$ $x = 2.65$	1	
	(ii) $y + \sqrt{h} = \frac{k^2}{x}$ $xy + x\sqrt{h} = k^2$ $xy = (-\sqrt{h})\,x + k^2$	1	
	$m = \frac{4-1}{0-4}$ $= -\frac{3}{4}$ $m = -\sqrt{h}$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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	$P(X \leq k) + P(X > k) = 1$ $4P(X \leq k) + P(X > k) = 1$ $P(X > k) = 0.2$ $\frac{k - 12}{\sqrt{25}} = 0.842$ $k = 16.21$	 1 2 1	 **10**

Bahagian C

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
12	(*a*) $v_A = 24t - 4t^2 - 20$ $\frac{dv}{dt} = 0$ $24 - 8t = 0$ $t = 3$ s $v_{\text{maksimum / } maximum} = 24(3) - 4(3)^2 - 20$ $= 16 \text{ m s}^{-1}$	 1 1 1	
	(*b*) (i) $s_A = \int (24t - 4t^2 - 20)\, dt$ $= \frac{24t^2}{2} - \frac{4t^3}{3} - 20t + c$ $t = 0, s_A = 0$ $0 = 12(0)^2 - \frac{4}{3}(0)^3 - 20(0) + c$ $c = 0$ $s_A = 12t^2 - \frac{4}{3}t^3 - 20t$ $s_B = \int (24t - 25)\, dt$ $= \frac{24t^2}{2} - 25t + c$ $t = 0, s_B = 0$ $0 = 12(0)^2 - 25(0) + c$ $c = 0$ $s_B = 12t^2 - 25t$ $s_A = s_B$ $12t^2 - \frac{4}{3}t^3 - 20t = 12t^2 - 25t$ $-\frac{4}{3}t^3 + 5t = 0$ $-t\left(\frac{4}{3}t^2 - 5\right) = 0$ $\frac{4}{3}t^2 = 5$ $t = \sqrt{\frac{15}{4}}$ $= 1.936$ s	1 1 1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(ii) $v_A = 0$ $24t - 4t^2 - 20 = 0$ $t^2 - 6t + 5 = 0$ $(t-1)(t-5) = 0$ $t = 1$ s, 5 s $s = \left\|\int_0^1 (24t - 4t^2 - 20)\,dt\right\| + \int_1^5 (24t - 4t^2 - 20)\,dt$ $= \left\|\left[12t^2 - \frac{4}{3}t^3 - 20t\right]_0^1\right\| + \left[12t^2 - \frac{4}{3}t^3 - 20t\right]_1^5$ $= \left\|\left[12(1)^2 - \frac{4}{3}(1)^3 - 20(1)\right] - \left[12(0)^2 - \frac{4}{3}(0)^3 - 20(0)\right]\right\| +$ $\left[\left[12(5)^2 - \frac{4}{3}(5)^3 - 20(5)\right] - \left[12(1)^2 - \frac{4}{3}(1)^3 - 20(1)\right]\right]$ $= \frac{28}{3} + \frac{128}{3}$ $= 52$ m	1 1 1 1	**10**
13	(*a*) (i) $x = 80$	1	
	(ii) $\frac{2.00}{y} \times 100 = 80$ $y = \text{RM}2.50$	1 1	
	(*b*) $\bar{I}_{20/18} = \frac{108 \times 60 + 104 \times 35 + 80 \times 5}{100}$ $= 105.20$	2 1	
	(*c*) $I_{21/20} = 140$ $I_{21/18} = \frac{105.20 \times 140}{100}$ $= 147.28$ $\frac{(43-5)}{P_{18}} \times 100 = 147.28$ $P_{18} = \text{RM}25.80$	 1 1 1 1	**10**
14	(*a*) (i) $\frac{1}{2}(2.8)(3)\sin 143° = \frac{1}{2}(3)(3.6)\sin \angle BCD$ $\angle BCD = 152.09°$	1 1	
	(ii) $AC^2 = 2.8^2 + 3^2 - 2(2.8)(3)$ kos / cos 143° $AC = 5.50$ cm $CE = 5.50 - 4 = 1.50$ cm	1 1 1	
	(iii) $\frac{2.8}{\sin \angle BCA} = \frac{5.50}{\sin 143°}$ $\sin \angle BCA = 0.3064$ $\angle BCA = 17.84°$ $BE^2 = 3^2 + 1.5^2 - 2(3)(1.5)$ kos / cos 143° $BE = 1.64$ cm	1 1 1	

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

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

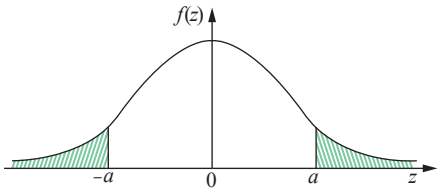
SIJIL PELAJARAN MALAYSIA 2022

KERTAS 1

Bahagian A

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

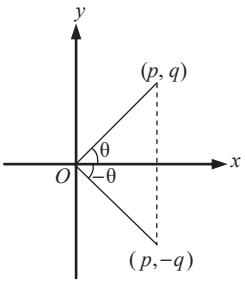
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
4	(*a*) $\frac{dV}{dt} = \frac{-5.5}{60}$ cm^3 s^{-1} $V = x^3$ $\frac{dV}{dx} = 3x^2$ Bila / *When* $x = 15$, $\frac{dV}{dx} = 3(15)^2$ $= 675$ $\frac{dx}{dt} = \frac{dx}{dV} \times \frac{dV}{dt}$ $= \frac{1}{dV} \times \frac{dV}{dt}$ $= \frac{1}{675} \times \frac{-5.5}{60}$ $= \frac{-11}{81\,000}$	1 1 1	
	(*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	6
5	$\overrightarrow{OP} = 2\underline{i} + 3\underline{j}$ $\overrightarrow{OQ} = q\underline{i} + 2q\underline{j}$ $\overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OQ}$ $= -2\underline{i} - 3\underline{j} + q\underline{i} + 2q\underline{j}$ $= (-2 + q)\underline{i} + (-3 + 2q)\underline{j}$ Vektor unit / *Unit vector*, $\lvert\overrightarrow{PQ}\rvert = 1$ 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 1 1 1	4
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	

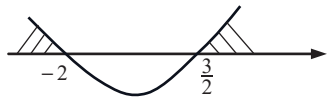
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	Ganti / *Substitute*, $p = -8, x = \frac{1}{2}, y = -6$ $-6 = \frac{(-8)\left(\frac{1}{2}\right)}{q\left(\frac{1}{2}\right) - 1}$ $-3q + 6 = -4$ $3q = 10$ $q = \frac{10}{3}$	1 1	4
7	(*a*) $\frac{120\pi}{180} = \frac{2}{3}\pi$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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
10	(*a*) (i) $\frac{\text{RM}24}{4} = 6$ $^{10}C_6 = 210$ cara / *ways*	1	
	(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) $1 \times 1 \times 1 \times 59 \times 58 = 3\,422$	1	
	(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*)	2	
	$= 1\,291\,584$ cara / *ways*	1	**8**
11	$BD = \sqrt{(2+x)^2 - (2-x)^2}$ $= \sqrt{8x}$	1	
	$\sqrt{x} + \sqrt{8x} = \sqrt{1+\sqrt{2}}$	1	
	Kuasa dua kedua-dua bahagian / *Squaring both sides*, $\left(\sqrt{8x} + \sqrt{x}\right)^2 = \left(\sqrt{1+\sqrt{2}}\right)^2$ $9x + 2x\sqrt{8} = 1 + \sqrt{2}$ $x\left(9 + 2\sqrt{8}\right) = 1 + \sqrt{2}$		
	$x = \frac{1+\sqrt{2}}{9+2\sqrt{8}} \times \frac{9-2\sqrt{8}}{9-2\sqrt{8}}$	1	
	$= \frac{9 + 5\sqrt{2} - 8}{(9)^2 - \left(2\sqrt{8}\right)^2}$	1	
	$= \frac{1 + 5\sqrt{2}}{(9)^2 - \left(2\sqrt{8}\right)^2}$		
	$= \frac{1+5\sqrt{2}}{49}$	1	**5**
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*	Markah Total *Total Marks*
	(*b*) (i) $\frac{1}{2} \times 12 \times x = 72$ $x = 12$ $T_{31} = a + (31 - 1)d$ $= 12$ Diberi / *Given*, $a = 30d$	1	
	$30d + (31 - 1)d = 12$ $60d = 12$ $d = \frac{1}{5}$	1 1	
	(ii) $a = 30\left(\frac{1}{5}\right)$ $= 6$ Luas / *Area* $= S_{31} \times 12 \times 4 \times 10^{-5}$ cm^2 kg $= \frac{31}{2}\left[2(6) + (31 - 1)\left(\frac{1}{5}\right)\right] \times 12 \times 4 \times 10^{-5}$ cm^2 kg $= 0.1339$ cm^2 kg	2	
	RM9: $\frac{2.5}{0.1339} \approx 18$ gulungan / *rolls* RM6: RM1.20 setiap / *every* 0.5 kg → 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* 36×0.1339 kg $= 4.821$ kg $5 - 4.821$ kg $= 0.179$ kg → 1 gulung lagi / *more roll* Bilangan gulungan maksimum = 36 + 1 *The number of maximum rolls is* $= 37$	1	**9**

Bahagian B

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

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

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

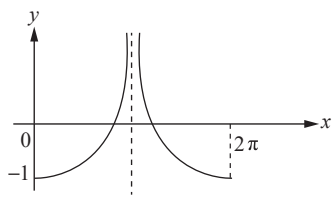
KERTAS 2

Bahagian A

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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
2	(*a*) (i) $-2m = -1$ $m = \frac{1}{2}$ $y - (-2) = \frac{1}{2}(x + 8)$ $y = \frac{1}{2}x + 2$ (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 1 1 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	**7**
3	(*a*) $\frac{5}{2} = \alpha + \beta$ $\frac{p}{2} = \alpha\beta$ $2\alpha - 1 + 2\beta - 1 = 2(\alpha + \beta) - 2$ $= 2\left(\frac{5}{2}\right) - 2$ $= 3$ $(2\alpha - 1)(2\beta - 1) = 4\alpha\beta - 2(\alpha + \beta) + 1$ $= 4\left(\frac{p}{2}\right) - 2\left(\frac{5}{2}\right) + 1$ $= 2p - 4$ $x^2 - (3)x + (2p - 4) = 0$ $x^2 - 3x + 2p - 4 = 0$	1 1 1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *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*) $x = r^4 = \frac{1}{16}$ $r = \pm\frac{1}{2}$ (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*	Markah Total *Total Marks*
5	$AB = 2 \times$ Panjang lengkok / *Length of the arc PQ*: $y = 2\left(\frac{3}{2}\pi x\right)$ $y = 3\pi x$.....①	2	
	Luas kawasan tak berumput / *Area of the non-grass region*: $6xy - \frac{1}{4}(3x)^2(\pi) = (90x + 27)\pi$ .....②	1	
	Ganti / *Substitute* ① ke dalam / *into* ②: $6x(3\pi x) - \frac{1}{4}(3x)^2(\pi) = (90x + 27)\pi$ .....③	1	
	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 / *Ignore*)	1	
	Ganti / *Substitute* $x = 6$ ke dalam / *into* ①: $y = 3\pi(6)$ $= 18\pi$ atau / *or* 56.56	1 1	**7**
6	(*a*) $\text{kot}\frac{x}{2} - \tan\frac{x}{2}$ $= \frac{1}{\tan\frac{x}{2}} - \tan\frac{x}{2}$ $= \frac{1 - \tan^2\frac{x}{2}}{\tan\frac{x}{2}}$ $= \frac{1}{\left(\frac{\tan\frac{x}{2}}{1 - \tan^2\frac{x}{2}}\right)}$ $= \frac{1}{\frac{1}{2}\tan x}$	1	
	$= 2\,\text{kot}\,x$	1	
	(*b*) (i) 	3	
	(ii) $m < -1$	1	**6**

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
7	(*a*) (i) $\frac{dy}{dx} : 6 - 2x = 0$ $x = 3$ $EH = 3 - p + 2p$ $= 3 + p$ (ii) $\int \frac{dy}{dx} = \int 6 - 2x$ $y = 6x - x^2 + c$ .....① Ganti / *Substitute* (0, 0) ke dalam / *into* ① $0 = 6(0) - 0^2 + c$ $c = 0$ $y = 6x - x^2$.....② Ganti / *Substitute* $x = 3 + p$ ke dalam / *into* ② $y = 6(3 + p) - (3 + p)^2$ $= 9 - p^2$ Luas / *Area*, $L = (9 - p^2 - 1)(2p)$ $= 16p - 2p^3$	1 1 1 1 1 1 1	
	(*b*) Luas maksimum / *Maximum area*: $\frac{dL}{dx} = 0$ $16 - 6p^2 = 0$ $p^2 = \pm\sqrt{\frac{8}{3}}$ $p = 1.633$ Jumlah kos / *Total cost* $= 40 \times [16(1.633) - 2(1.633)^3]$ $=$ RM697	 1 1 2	**10**

Bahagian B

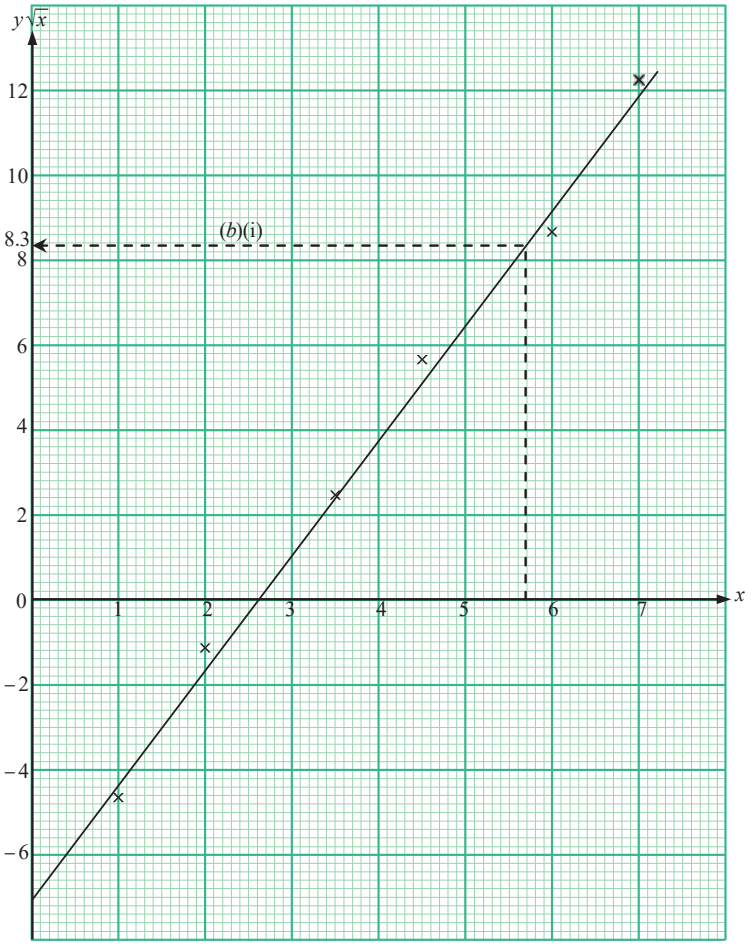
8	(*a*) (i) $\overrightarrow{OP} = \overrightarrow{OA} + \overrightarrow{AP}$ $= \underline{a} + \frac{1}{3}(-\underline{a} + \underline{b})$ $= \frac{2}{3}\underline{a} + \frac{1}{3}\underline{b}$ (ii) $\overrightarrow{BQ} = \overrightarrow{BO} + \overrightarrow{OQ}$ $= -\underline{b} + k\left(\frac{2}{3}\underline{a} + \frac{1}{3}\underline{b}\right)$ $= -\underline{b} + \frac{2}{3}k\underline{a} + \frac{k}{3}\underline{b}$	1 1 1 1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *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	
	(*c*) $5BQ = 2BC$ $BQ : QC = 2 : 3$	1	**10**
9	(*a*) (i) ${}^8C_8(0.9772^8)(0.0228^0)$ $= 0.8315$	1 1	
	(ii) $P(X \leqslant 6)$ $= 1 - {}^8C_8(0.9772^8)(0.0228^0) - {}^8C_7(0.9772^7)(0.0228^1)$ $= 0.0133$	2 1	
	(*b*) $\frac{61 - 60}{\sigma} = 1.999$ $\sigma = 0.5$ $P(X < 60.5)$ $= P\left(Z < \frac{60.5 - 60}{0.5}\right)$ $= P(Z < 1)$ $= 1 - P(Z \geqslant 1)$ $= 0.8413$	2 1 1 1	**10**
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*	Markah Total *Total Marks*
	Luas kawasan berlorek / *Shaded area region* $= \frac{1}{2}\left(2 + \frac{3}{2}\right)(5) + \frac{16}{3}$ $= 14.08$	2 1	
	(*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	**10**
11	(*a*)		

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

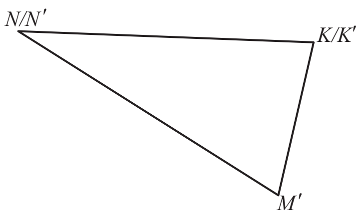
1

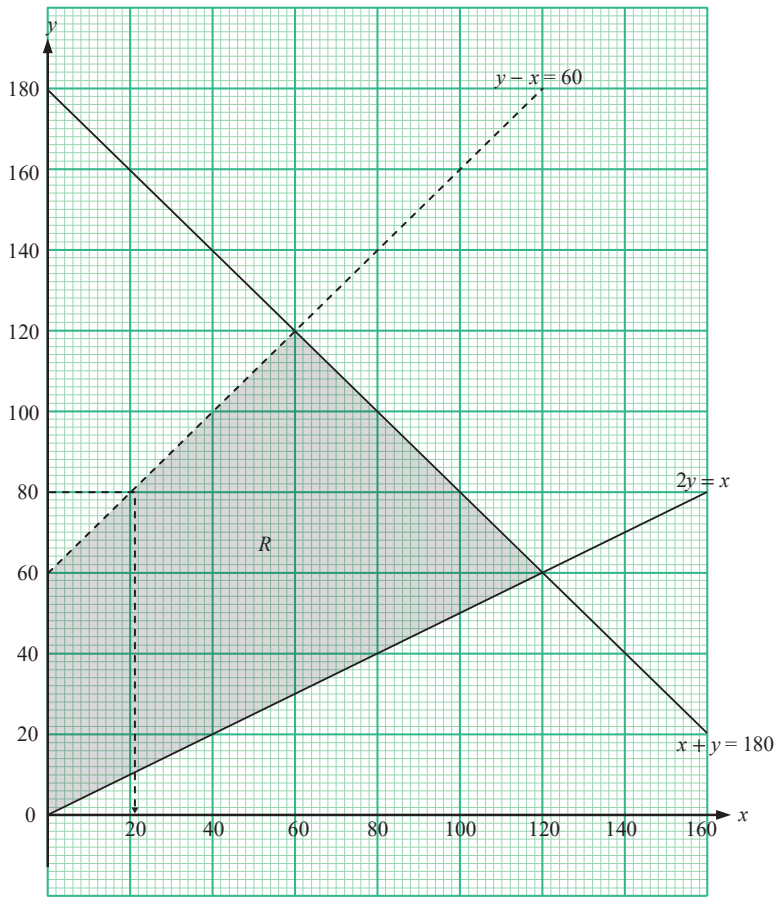


3

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

Bahagian C

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

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

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

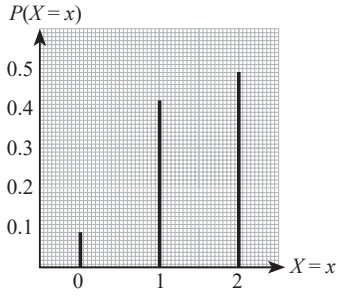
KERTAS 1

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	
	(*b*) (i) $f(0) = h$ $\lvert 5 - 0\rvert = h$ $h = 5$ $f\left(\frac{5}{8}\right) = 0$ $\left\lvert 5 - \frac{5}{8}k\right\rvert = 0$ $5 - \frac{5}{8}k = 0$ $-\frac{5}{8}k = -5$ $k = 8$ (ii) $0 \leqslant f(x) \leqslant 13$ (iii) $f(x)$ mempunyai fungsi songsang kerana fungsi ini mempunyai hubungan satu kepada satu. *$f(x)$ has an inverse function because it is one-to-one relation.*	 1 1 1 1 1	7
2	(*a*) $1 - 6x = 0$ $x = \frac{1}{6}$	1	
	(*b*) Anggap / *Let* $y = f^{-1}(x)$ $f(y) = x$ $\frac{p}{1-6y} = x$ $p = x(1 - 6y)$ $p = x - 6xy$ $6xy = x - p$ $y = \frac{x-p}{6x}$ $y = \frac{1}{6} - \frac{p}{6x}$ $f^{-1}(x) = \frac{1}{6} - \frac{p}{6x}$ Maka / *Then*, $-\frac{p}{6} = -\frac{2}{q}$ $\frac{p}{6} = \frac{2}{q}$ $p = \frac{12}{q}$	 1 1 1	4
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	

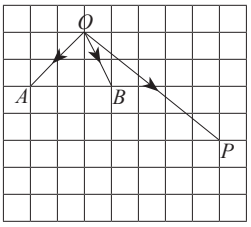
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	Guna / *Use* $b^2 - 4ac > 0$ $(-6b)^2 - 4(3)(3b^2 + a) > 0$ $36b^2 - 36b^2 - 12a > 0$ $-12a > 0$ $a < \frac{0}{-12}$ $a < 0$; tertunjuk / *shown*	1 1	**3**
4	(*a*) $(x-3)^2 = x - 5$ $x^2 - 6x + 9 - x + 5 = 0$ $x^2 - 7x +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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
6	$y = an^x$ $\log_2 y = \log_2 an^x$ $\log_2 y = \log_2 a + \log_2 n^x$ $\log_2 y = (\log_2 n)x + \log_2 a$ $Y = \quad m \quad X + c$ Kecerunan / *Gradient*: $\log_2 n = \dfrac{10 - 4}{3 - 1}$ $\log_2 n = 3$ $n = 2^3$ $n = 8$ Pada / *At* (1, 4); $4 = 3(1) + c$ $c = 1$ $\log_2 a = 1$ $a = 2$	 1 1 1 1 1	**5**
7	(*a*) Bilangan digit / *Number of digits* = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 = 10 ${}^{10}P_4 = 5\,040$	1	
	(*b*) ${}^4C_2 \times {}^2P_2 \times {}^3P_1$ $= {}^4C_2 \times {}^2P_2 \times {}^3P_1 \times 6 \times 6$ $= 1\,296$	1 1 1	**4**
8	(*a*) $\delta y = [2(x + \delta x) - (x + \delta x)^2] - (2x - x^2)$ $\delta y = 2x + 2\delta x - (x + \delta x)(x + \delta x) - 2x + x^2$ $\delta y = 2x + 2\delta x - [x^2 + x\delta x + x\delta x + (\delta x)^2] - 2x + x^2$ $\delta y = 2x + 2\delta x - [x^2 + 2x\delta x + (\delta x)^2] - 2x + x^2$ $\delta y = 2x + 2\delta x - x^2 - 2x\delta x - (\delta x)^2 - 2x + x^2$ $\delta y = 2\delta x - 2x\delta x - (\delta x)^2$ $\dfrac{\delta y}{\delta x} = 2 - 2x - \delta x$ $\dfrac{dy}{dx} = \lim\limits_{\delta x \to 0} 2 - 2x - \delta x$ $\dfrac{dy}{dx} = 2 - 2x$	1 1 1	
	(*b*) (i) Katakan / *Let* $u = 12\,000t$, Katakan / *Let* $v = 1 + t^3$ $\dfrac{du}{dt} = 12\,000$ $\quad \dfrac{dv}{dt} = 3t^2$ $\dfrac{dP}{dt} = \dfrac{v\dfrac{du}{dt} - u\dfrac{dv}{dt}}{v^2}$ $\dfrac{dP}{dt} = \dfrac{(1 + t^3)(12\,000) - 12\,000t(3t^2)}{(1 + t^3)^2}$ $\dfrac{dP}{dt} = \dfrac{12\,000 + 12\,000t^3 - 36\,000t^3}{(1 + t^3)^2}$ $\dfrac{dP}{dt} = \dfrac{12\,000 + 24\,000t^3}{(1 + t^3)^2}$ $0 = \dfrac{12\,000 + 24\,000t^3}{(1 + t^3)^2}$ $0 = 12\,000 - 24\,000t^3$	 1 1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	$24\,000t^3 = 12\,000$ $t^3 = \frac{12\,000}{24\,000}$ $t^3 = 0.5$ $t = 0.7937$ jam / *hours* $t \approx 48$ 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*) $X = \{0, 1, 2\}$	1	
	(*b*) $P(X = 0) = {}^2C_0(0.7)^0(0.3)^{2-0} = 0.09$ $P(X = 1) = {}^2C_1(0.7)^1(0.3)^{2-1} = 0.42$ $P(X = 2) = {}^2C_2(0.7)^2(0.3)^{2-2} = 0.49$  	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*) $\sin A = \frac{a}{c}$, kos $A = \frac{b}{c}$, $\tan A = \frac{a}{b}$ 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: $\frac{a^2}{b^2} + \frac{b^2}{b^2} = \frac{c^2}{b^2}$ $\frac{a^2}{b^2} + 1 = \frac{c^2}{b^2}$ $\left(\frac{a}{b}\right)^2 + 1 = \left(\frac{c}{b}\right)^2$ $\therefore \tan^2 A + 1 = \text{sek}^2 A$	1 1 1	
	(*b*) $(1 + \tan A)^2 = (1 + \tan A)(1 + \tan A)$ $= 1 + 2\tan A + \tan^2 A$ $= 1 + \tan^2 A + 2\tan A$ $= \text{sek}^2 A + 2\frac{\sin A}{\text{kos } A}$ $= \text{sek}^2 A + 2\frac{\sin A}{\text{kos } A} \cdot \frac{\text{kos } A}{\text{kos } A}$ $= \text{sek}^2 A + 2\frac{\sin A \text{ kos } A}{\text{kos}^2 A}$ $= \text{sek}^2 A + 2 \sin A \text{ kos } A \left(\frac{1}{\text{kos}^2 A}\right)$ $= \text{sek}^2 A + \sin 2A \text{ sek}^2 A$ $= \text{sek}^2 A(1 + \sin 2A)$	1 1 1	**6**

Bahagian B

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
13	(*a*) (i) 	2	
	(ii) $\overrightarrow{OP} = 3\begin{pmatrix}-1\\-4\end{pmatrix} - \begin{pmatrix}2\\4\end{pmatrix}$	1	
	$\overrightarrow{OP} = \begin{pmatrix}-5\\-16\end{pmatrix}$		
	$\lvert\overrightarrow{OP}\rvert = \sqrt{(-5)^2 + (-16)^2}$	1	
	$\lvert\overrightarrow{OP}\rvert = \sqrt{281}$	1	
	(*b*) $\lambda\left(-\frac{1}{4}h\underline{p} - 2\underline{q}\right) = (1-k)\underline{p} + 2h\underline{q}$	1	
	$-\frac{1}{4}h\lambda\underline{p} - 2\lambda\underline{q} = (1-k)\underline{p} + 2h\underline{q}$		
	$-\frac{1}{4}h\lambda = 1-k$, $-2\lambda = 2h$ $\lambda = -h$	1	
	$-\frac{1}{4}h(-h) = 1-k$		
	$h^2 = 4(1-k)$		
	$h = 2\sqrt{1-k}$	1	**7**
14	(*a*) $P(0, -20)$ dan / *and* $R(0, 20)$	1 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* $= \frac{1}{2}\left(10\sqrt{2}\right)^2(\pi)$ $= 100\pi$	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* $= 200\pi - (200 + 50\pi - 100)$ $= 150\pi - 100$	1	
	$= 50(3\pi - 2)$	1	**8**

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
15	(*a*) $\frac{T_3}{T_2} = \frac{\frac{m^5}{27}}{\frac{m^3}{3}} = 1$	1	
	$\frac{m^2}{9} = 1$ $m^2 = 9$ $m = 3, m = -3$	1	
	(*b*) (i) T_2: $ar^{2-1} = \frac{m^3}{3}$		
	$ar = \frac{m^3}{3}$		
	T_3: $ar^{3-1} = \frac{m^5}{27}$		
	$ar^2 = \frac{m^5}{27}$		
	$\frac{ar^2}{ar} = \frac{\frac{m^5}{27}}{\frac{m^3}{3}}$	1	
	$r = \left(\frac{m^5}{27}\right) \times \left(\frac{3}{m^3}\right)$		
	$r = \frac{m^2}{9}$		
	$r = \frac{(4)^2}{9}$	1	
	$r = \frac{16}{9}$	1	
	$ar = \frac{64}{3}$		
	$a\left(\frac{16}{9}\right) = \frac{64}{3}$		
	$a = \frac{64}{3} \div \frac{16}{9}$		
	$a = \frac{64}{3} \times \frac{9}{16}$		
	$a = 12$	1	
	(ii) $S_{2\to5} = S_5 - S_1$		
	$= \frac{12\left[\left(\frac{16}{9}\right)^5 - 1\right]}{\left(\frac{16}{9}\right) - 1} - 12$	1	
	$= \frac{565\,444}{2\,187} - 12$		
	$= \frac{539\,200}{2\,187}$ atau / *or* $S_{2\to5} = 246.5478$	1	**8**

KERTAS 2

Bahagian A

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
1	Diberi (6, –4) dan kecerunan $\frac{1}{2}$. *Given* (6, –4) *and gradient* $\frac{1}{2}$. $-4 = m(6) + \frac{1}{2}$ $6m = -\frac{9}{2}$ $m = -\frac{3}{4}$ Maka / *Thus*, $y = -\frac{3}{4}x + \frac{1}{2}$ .....① Ganti ① ke dalam / *Substitute* ① *into* $x^2 + xy - 6 = 0$: $x^2 + x\left(-\frac{3}{4}x + \frac{1}{2}\right) - 6 = 0$ $x^2 - \frac{3}{4}x^2 + \frac{1}{2}x - 6 = 0$ $\frac{1}{4}x^2 + \frac{1}{2}x - 6 = 0$ $\frac{1}{4}(x + 6)(x - 4) = 0$ $x = -6, x = 4$ 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* $B\left(4, -\frac{5}{2}\right)$.	1 1 1 1 2	6
2	(*a*) $\sqrt{320} - \sqrt{45} = \sqrt{64}\cdot\sqrt{5} - \sqrt{9}\cdot\sqrt{5}$ $= 8\sqrt{5} - 3\sqrt{5}$ $= 5\sqrt{5}$ Maka / *Thus*, $a = 5$	1 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*
	$(12 + 6\sqrt{3}) \text{ kos } \theta = 12 + 4\sqrt{3}$ $\text{kos } \theta = \dfrac{12 + 4\sqrt{3}}{12 + 6\sqrt{3}}$	1	
	Menisbahkan penyebut / *Rationalising the denominator*: $\text{kos } \theta = \dfrac{12 + 4\sqrt{3}}{12 + 6\sqrt{3}} \cdot \dfrac{12 - 6\sqrt{3}}{12 - 6\sqrt{3}}$ $= \dfrac{144 - 72\sqrt{3} + 48\sqrt{3} - 24(3)}{144 - 72\sqrt{3} + 72\sqrt{3} - 36(3)}$ $= \dfrac{72 - 24\sqrt{3}}{36}$ $= \dfrac{6 - 2\sqrt{3}}{3}$	1 1	6
3	(*a*) $\dfrac{dy}{dx} = 3ax^2 + b$ Pada / *At* $x = 3$, Kecerunan lengkung / *Gradient of curve*: $-15 = \dfrac{dy}{dx}$ $-15 = 3a(3)^2 + b$ $-15 = 27a + b$ ... ① Pada / *At* $(-2, -11)$ $-11 = a(-2)^3 + b(-2) + 5$ $-16 = -8a - 2b$ $-8 = -4a - b$ ... ② ① + ②: $-15 = 27a + b$ $+ \quad -8 = -4a - b$ $-23 = 23a$ $a = -1$ $-15 = 27(-1) + b$ $b = 12$	1 1 1 1 1	
	(*b*) $\dfrac{dy}{dx} = 3(-1)x^2 + 12$ $0 = -3x^2 + 12$ $3x^2 = 12$ $x^2 = 4$ $x = \pm 2$ Nilai maksimum / *Maximum value* = 2 $y = -1(2)^3 + 12(2) + 5$ $y = 21$ Titik maksimum / *Maximum point* = (2, 21)	 1 1	7

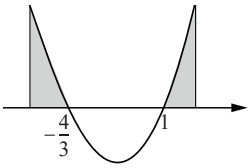
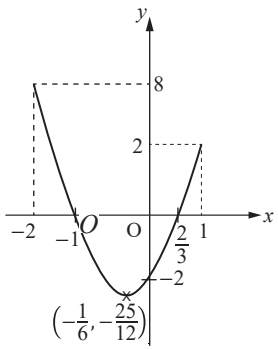
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
4	(*a*) (i) $\overrightarrow{QT} = \overrightarrow{QO} + \overrightarrow{OT}$ $= -8\underline{a} + 2\underline{b}$	1	
	(ii) $\overrightarrow{PS} = \overrightarrow{PO} + \overrightarrow{OS}$ $= -4\underline{a} + 5\underline{b}$	1	
	(*b*) (i) $\overrightarrow{OR} = \overrightarrow{OQ} + \overrightarrow{QR}$ $= 8\underline{a} + m(-8\underline{a} + 2\underline{b})$ $= (8 - 8m)\underline{a} + 2m\underline{b}$	1 1	
	(ii) $\overrightarrow{OR} = \overrightarrow{OS} + \overrightarrow{SR}$ $\overrightarrow{OR} = \overrightarrow{OS} - \overrightarrow{RS}$ $= 5\underline{b} - n(-4\underline{a} + 5\underline{b})$ $= 4n + (5 - 5n)\underline{b}$	 1	
	(*c*) Diketahui / *It is known that* $8 - 8m = 4n$, $2m = 5 - 5n$ $8m = 20 - 20n$ $8 - (20 - 20n) = 4n$ $2m = 5 - 5\left(\frac{3}{4}\right)$ $-12 + 20n = 4nm$ $16n = 12$ $m = \frac{5}{8}$ $n = \frac{3}{4}$	1 1 1	**8**
5	(*a*) $\theta = \frac{1}{5}\pi$ Perimeter $= 2r + r\left(\frac{1}{5}\pi\right)$, Luas / *Area* $= \frac{1}{2}r^2\left(\frac{1}{5}\pi\right)$ $2r + r\left(\frac{1}{5}\pi\right) = \frac{1}{2}r^2\left(\frac{1}{5}\pi\right)$ $\left(2 + \frac{1}{5}\pi\right)r = \left(\frac{1}{10}\pi\right)r^2$ $r = \frac{\left(2 + \frac{1}{5}\pi\right)}{\left(\frac{1}{10}\pi\right)}$ $r = 8.365$ cm	1 1 1 1	
	(*b*) Isi padu sepotong kek / *Volume per slice of cake* $= \pi(8.365)^2(12) \div 10$ $= 263.79\ \text{cm}^3$ Jisim sepotong kek / *Mass per slice of cake* $= 263.79 \div 0.916$ $= 287.98$ g Harga sepotong kek / *Price per slice of cake* $= \frac{287.98\text{ g}}{100\text{ g}} \times \text{RM}4.90$ = RM14.11 sepotong / *per slice* Bilangan sepotong kek / *Number of slice of cake* $= \frac{\text{RM}180}{\text{RM}14.11}$ $= 112.76$ $\approx$ 12 potong / *slices*	1 1 1 1	**8**

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	
	$S_{16} = \frac{16}{2}\left[2\left(\frac{b^2h}{3}\right) + (16-1)\left(\frac{b^2}{3}\right)\right]$	1	
	$= \frac{16}{3}b^2h + 40b^2$	1	**8**
7	(*a*) (i) ${}^{10}C_4 = 210$	1	
	(ii) $({}^3C_2 \times {}^7C_1 \times {}^3C_1) + ({}^3C_3 \times {}^3C_1)$ $= 66$	2 1	
	(*b*) ${}^5C_1 \times {}^2C_1$ atau / *or* ${}^2P_2 \times {}^3P_1$ ${}^5C_1 \times {}^2C_1 \times {}^2P_2 \times {}^3P_1 \times {}^9P_3$ $= 30\,240$	1 1 1	**7**

Bahagian B

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
8	(*a*) HTP / *SOR*: $p + q = -\frac{1}{\frac{9p}{2}}$ HDP / *POR*: $pq = \frac{2q}{\frac{9p}{2}}$	1	
	$p + q = -\frac{2}{9p}$ $pq = \frac{4q}{9p}$ $9p(p+q) = -2$ $9p^2q = 4q$ $9p^2 + 9pq = -2$ $9p^2 = 4$ $p^2 = \frac{4}{9}$ $p = \pm\frac{2}{3}$	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) $3x^2 + x - 2 > 2$ $3x^2 + x - 4 > 0$ $(3x + 4)(x - 1) > 0$  $x < -\frac{4}{3}, x > 1$	1 1	
	(ii) $f(x) = 3\left(x^2 + \frac{x}{3} - \frac{2}{3}\right)$ $= 3\left[x^2 + \frac{x}{3} + \left(\frac{1}{3}{2}\right)^2 - \left(\frac{1}{3}{2}\right)^2 - \frac{2}{3}\right]$ $= 3\left[\left(x + \frac{1}{6}\right)^2 - \frac{25}{36}\right]$ $= 3\left(x + \frac{1}{6}\right)^2 - \frac{25}{12}$ 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	

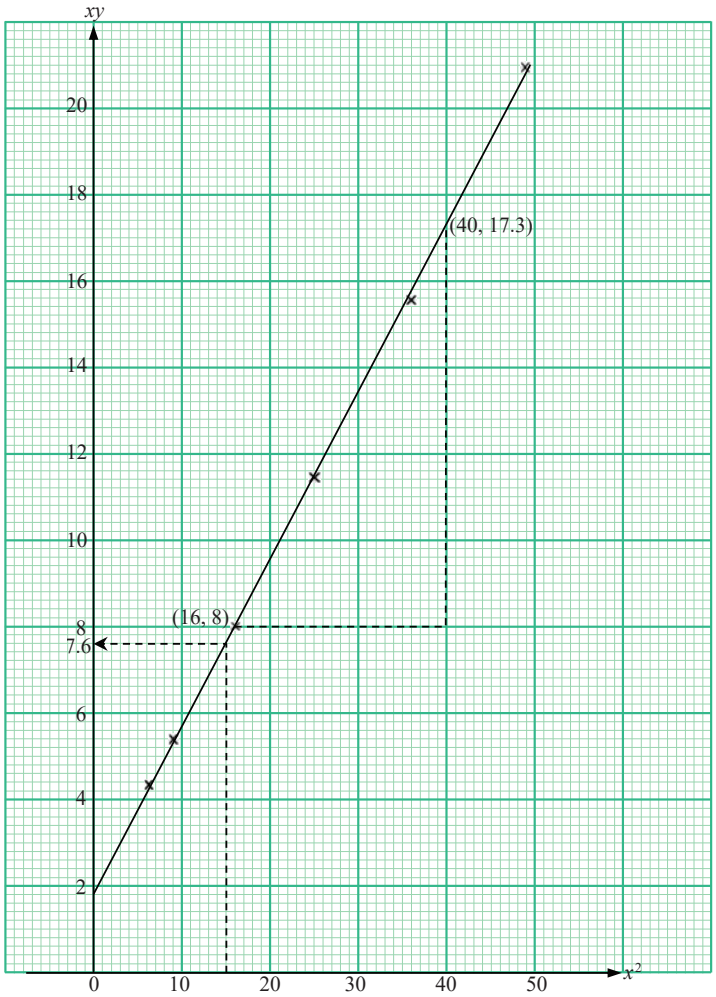
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*c*) $-2 + p = -2 - \frac{2}{3}$ dan / *and* $3q = 3(1)$ $= -\frac{8}{3}$ $= 3$ HTP / *SOR* $= -\frac{8}{3} + 3$ HDP / *POR* $= -\frac{8}{3}(3)$ $= \frac{1}{3}$ $= -8$ $\therefore x^2 - \frac{1}{3}x - 8 = 0$	1 1	**10**
9	(*a*)		

x^2	6.25	9	16	25	36	49
xy	4.38	5.4	8	11.5	15.6	21

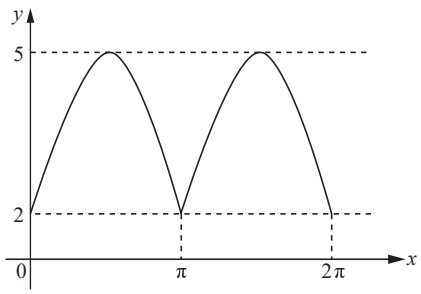
2

- Semua titik diplot dengan betul.
  All points are plotted correctly. 1

- Garis penyuaian terbaik.
  The line of best fit. 1



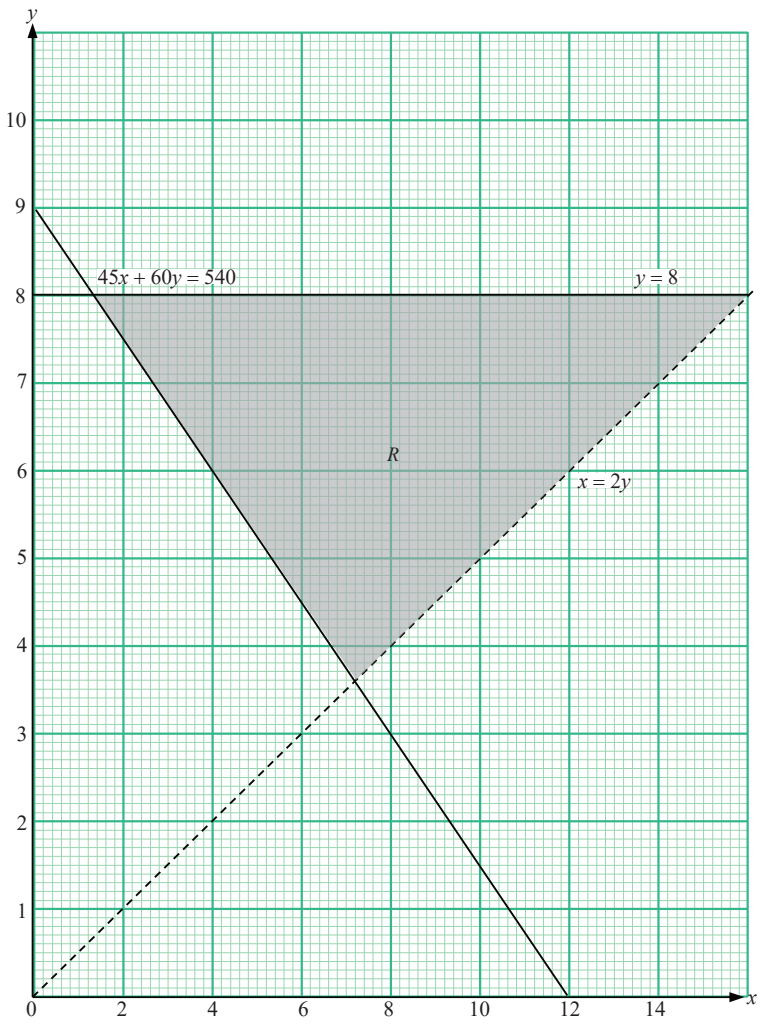
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) (i) $xy = \frac{b}{a}x^2 + a$	1	
	Apabila / *When* $x^2 = 15$, $xy = 7.6$ $y = \frac{7.6}{\sqrt{15}}$	1	
	$y = 1.962$	1	
	(ii) $a = 1.9$	1	
	m: $\frac{b}{a} = \frac{17.3 - 8}{40 - 16}$ $\frac{b}{1.9} = \frac{17.3 -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

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

Bahagian C

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

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*) $I_{\frac{2018}{2016}} = \frac{120(2) + 100(3) + 95(3) + 100(2)}{10}$ $= 102.5$	1	
	<table><tr><td>P_0 \ 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>		
	$\frac{122.3}{100} = \frac{x}{102.5}$ $x = 125.87$	1	
	(*d*) $\frac{P_{2018}}{20} \times 100 = 125.87$ $P_{2018} = \text{RM}25.17$	1 1	**10**
14	(*a*) $45x + 60y \geqslant 540$ $x < 2y$ $y \leqslant 8$	1 1 1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) – Semua garis lurus dilukis dengan betul. *All straight lines are drawn correctly.* – Kawasan berlorek yang betul. *Correct shaded region.*  	1 2	
	(*c*) (i) $4 < y \leqslant 8$ (ii) Titik maksimum / *Maximum point* = (15, 8) Bilangan maksimum bilangan kopi = 23 × 18 *Maximum number of coffee drink* = 414	1 1 1 1	**10**

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
15	(*a*) $v = \int kt - 10 \, dt$		
	$v = \frac{kt^2}{2} - 10t + c$	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* $0 = 3t^2 - 10t - 8$ $t = 2$ $0 = (3t + 2)(t - 4)$ $t = 4$	1	
	$\int_2^4 \lvert 3t^2 - 10t - 8 \rvert \, dt$	1	
	$= \left\lvert \frac{3t^3}{3} - \frac{10t^2}{2} - 8t \right\rvert_2^4$ $= \left\lvert \left(\frac{3(4)^3}{3} - \frac{10(4)^2}{2} - 8(4)\right) - \left(\frac{3(2)^3}{3} - \frac{10(2)^2}{2} - 8(2)\right) \right\rvert$	1	
	$= \lvert -20 \rvert$ $= 20$	1	**10**

KERTAS MODEL SIJIL PELAJARAN MALAYSIA 2023 SET 2

KERTAS 1

Bahagian A

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

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 1	
	(*b*) $^4C_4p^4q^0 = 0.3$ $(1)(p^4)(1) = 0.3$ $p^4 = 0.3$ $p = \sqrt[4]{0.3}$ $p = 0.7401$ Min / *Mean* $= (4)(0.7401)$ $= 2.9604$	1 1 1 1	**6**
5	$\kos 2\theta = \sin\theta$ $\kos^2\theta - \sin^2\theta = \sin\theta$ $(1 - \sin^2\theta) - \sin^2\theta - \sin\theta = 0$ $-2\sin^2\theta - \sin\theta + 1 = 0$ $2\sin^2\theta + \sin\theta - 1 = 0$ $(2\sin\theta - 1)(\sin\theta + 1) = 0$ $2\sin\theta - 1 = 0$, $\sin\theta + 1 = 0$ $\sin\theta = \frac{1}{2}$ (**I** dan / *and* **II**) $\sin\theta = -1$ (**III** dan / *and* **IV**) Sudut asas / *Basic angle*: 30° Sudut asas / *Basic angle*: 90° $\therefore \theta = 30°, 150°, 270°$	 1 1 1 1 1	**5**
6	(*a*) $\frac{dx}{dy} = (2x - 1)^2$; $A(-1, 3)$ $= [2(-1) - 1]^2$ $= (-3)^2$ $= 9$ $m_1m_2 = -1$ $9 \times m_2 = -1$ $m_2 = -\frac{1}{9}$ Persamaan normal di $A(-1, 3)$ / *Equation of normal at* $A(-1, 3)$: $y - y_1 = m(x - x_1)$ $y - 3 = -\frac{1}{9}[x - (-1)]$ $y - 3 = -\frac{1}{9}(x + 1)$ $y = -\frac{1}{9}x - \frac{1}{9} + 3$ $y = -\frac{1}{9}x + \frac{26}{9}$ atau / *or* $9y + x = 26$	 1 1 1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) $\int dy = \int (2x-1)^2\, dx$ $y = \frac{(2x-1)^3}{(3)(2)} + c$ $y = \frac{(2x-1)^3}{6} + c$; $A(-1, 3)$ $3 = \frac{[2(-1)-1]^3}{6} + c$ $3 = -\frac{9}{2} + c$ $\frac{15}{2} = c$ $\therefore y = \frac{(2x-1)^3}{6} + \frac{15}{2}$ 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	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*: $y - y_1 = m(x - x_1)$ $y - \frac{7}{2} = \frac{9}{2}\left(x - \frac{5}{4}\right)$ $y = \frac{9}{2}x - \frac{45}{8} + \frac{7}{2}$ $y = \frac{9}{2}x - \frac{17}{8}$ atau / *or* $8y = 36x - 17$	1 1 1	

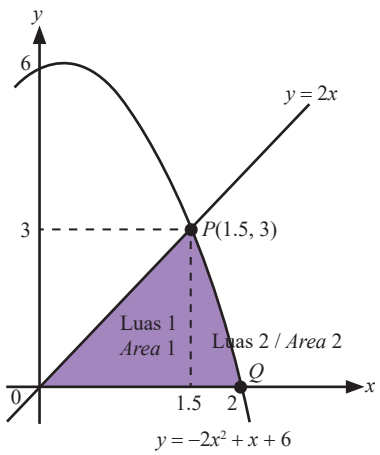
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*c*) $AP = PB$ $\sqrt{[x-(-1)]^2+(y-4)^2} = \sqrt{(x-8)^2+(y-2)^2}$ $(x+1)^2+(y-4)^2 = (x-8)^2+(y-2)^2$ $x^2+2x+1+y^2-8y+16 = x^2-16x+64+y^2-4y+4$ $18x-4y-51=0$	1 1 1	**8**
9	$2x^2-6x+5=0$ Punca / *Roots*: α, β HTP / *SOR*: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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	$\underline{i}$: $19 - 2m = 3$ $-2m = -16$ $m = 8$ $\underline{j}$: $20 - 2n = -6$ $-2n = -26$ $n = 13$	 1 1	
	(*b*) Luas / *Area* $= \frac{1}{2}\begin{vmatrix} -1 & 6 & 8 & -1 \\ 4 & 8 & 13 & 4 \end{vmatrix}$ $= \frac{1}{2}\lvert(-8 + 78 + 32) - (24 + 64 - 13)\rvert$ $= \frac{1}{2}\lvert102 - 75\rvert$ $= \frac{1}{2}(27)$ $= 13\frac{1}{2}$ unit^2	 1 1	6
12	(*a*) $\int_4^1 f(x)\,dx = -\int_1^4 f(x)\,dx$ $= -10$	 1	
	(*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	6

Bahagian B

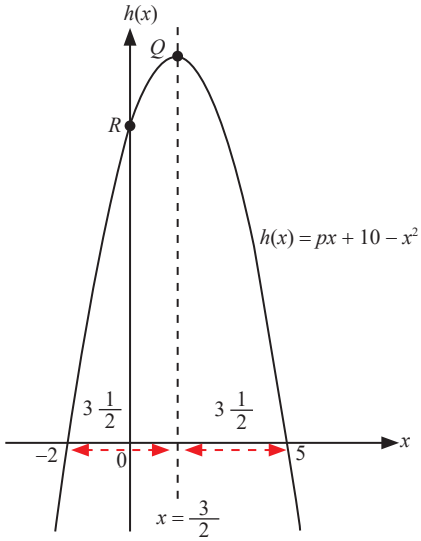
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
13	(*a*) $3x^2 - 2x - 5 = 0$ $(3x - 5)(x + 1) = 0$ $3x - 5 = 0$, $x + 1 = 0$ $x = \frac{5}{3}$ $x = -1$ $\therefore A\left(\frac{5}{3}, 0\right)$ dan / *and* $B(-1, 0)$	 2 2	

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*) $\theta = \frac{(360° - 240°)}{180°} \times \pi$ $= 2.095$ rad	1 1	
	(*b*) $s = r\theta$ $20 = r(2.095)$ $\frac{20}{2.095} = r$ $9.5465 \text{ cm} = r$	1 1	
	(*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* $= \frac{1}{2} ab \sin C$ $= \frac{1}{2}(9.4565)(9.4565) \sin 120°$ $= 38.7223 \text{ cm}^2$ 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	**8**

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
15	(*a*) Q adalah pintasan-x / Q *is* x*-intercept* $\rightarrow y = 0$ $-2x^2 + x + 6 = 0$ $2x^2 - x - 6 = 0$ $(2x + 3)(x - 2) = 0$ $x - 2 = 0$, $2x + 3 = 0$ $x = 2$ $= -\frac{3}{2}$ (Abaikan / *Ignore*) $\therefore Q(2, 0)$	1 1 1	
	(*b*)  Luas / *Area* 1 = Luas segi tiga / *Area of triangle* $= \frac{1}{2} \times 1.5 \times 3$ $= 2\frac{1}{4}$ unit^2 Luas / *Area* 2 $= \int_{1.5}^{2} (-2x^2 + x + 6)\,dx$ $= \left[-\frac{2x^3}{3} + \frac{x^2}{2} + 6x \right]_{1.5}^{2}$ $= \left[-\frac{2(2)^3}{3} + \frac{(2)^2}{2} + 6(2) \right] - \left[-\frac{2(1.5)^3}{3} + \frac{(1.5)^2}{2} + 6(1.5) \right]$ $= 8\frac{2}{3} - 7\frac{7}{8}$ $= \frac{19}{24}$ unit^2 Luas kawasan berlorek = Luas 1 + Luas 2 *Area of the shaded region* = *Area* 1 + *Area* 2 $= 2\frac{1}{4} + \frac{19}{24}$ $= 3\frac{1}{24}$ unit^2	1 1 1 1 1	8

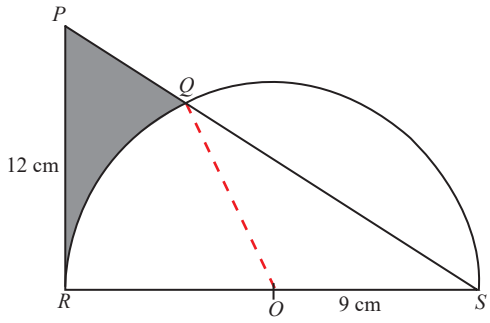
KERTAS 2

Bahagian A

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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	$\frac{x+5}{2} = \frac{3}{2}$ $2x + 10 = 6$ $2x = -4$ $x = -2$ $\therefore h(x) < 0$ apabila $x < -2$ atau $x > 5$ $h(x) < 0$ *when* $x < -2$ *or* $x > 5$	1 1	
	(*c*) $h(x) = -x^2 + px + 10$ $= -(x^2 - px - 10)$ $= -\left[x^2 - px + \left(-\frac{p}{2}\right)^2 - \left(-\frac{p}{2}\right)^2 - 10\right]$ $= -\left[\left(x - \frac{p}{2}\right)^2 - \frac{p^2}{4} - 10\right]$ $= -\left(x - \frac{p}{2}\right)^2 + \frac{p^2}{4} + 10$ $x - \frac{p}{2} = 0$ $x = \frac{p}{2}$ $\frac{3}{2} = \frac{p}{2}$ $p = 3$	1 1 1 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 1	**9**
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	
	(*b*) $3^{x+2} - 3^x + 45(3^{x-2}) = (3^x)(3^2) - 3^x + 45(3^x)\left(\frac{1}{3^2}\right)$ $= (3^x)\left[3^2 - 1 + 45\left(\frac{1}{3^2}\right)\right]$ $= (3^x)(9 - 1 + 5)$ $= 13(3^x)$ $3^{x+2} - 3^x + 45(3^{x-2})$ 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*.	1 1 1	**6**

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

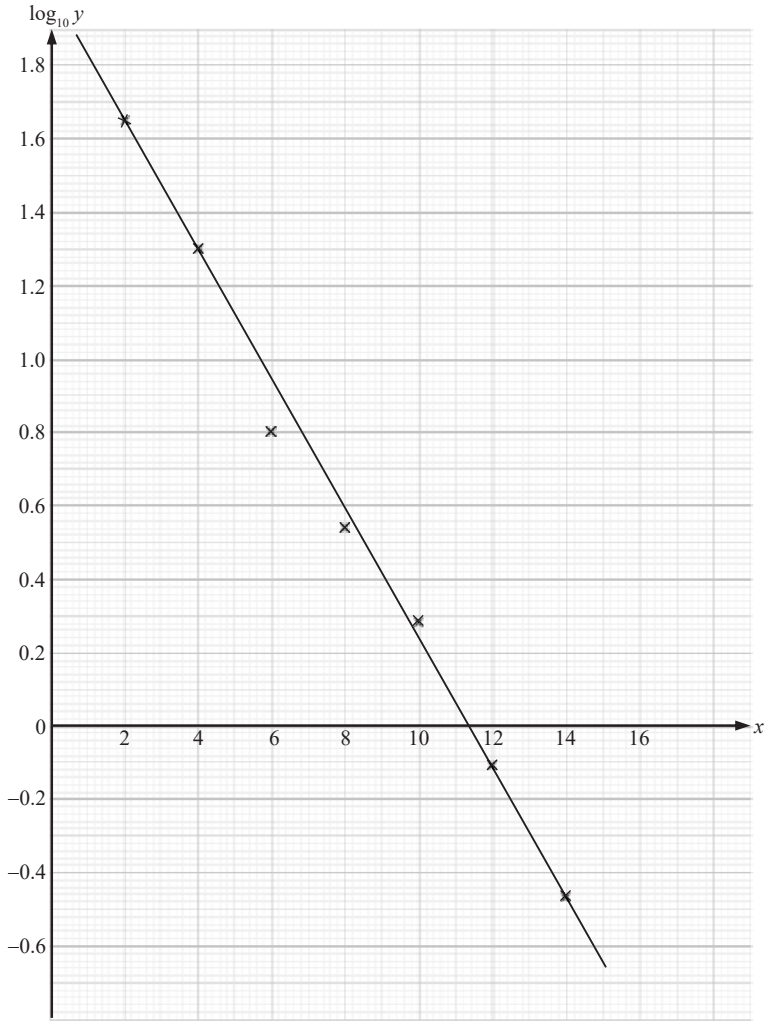
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
5	 $\angle PSR = \tan^{-1}\left(\frac{12}{18}\right)$ $= 33.69°$ $= 0.5881$ rad $\angle QOS = 180° - 33.69° - 33.69°$ $= 112.62°$ $\angle QOR = 180° - 112.62°$ $= 67.38°$ $= 1.1762$ rad *Lengkok RQ* / *Arc of RQ* $= (9)(1.1762)$ $= 10.5858$ cm $SQ^2 = 9^2 + 9^2 - 2(9)(9)$ kos / *cos* $112.62°$ $SQ = \sqrt{224.3080}$ $= 14.9769$ cm $PS^2 = 12^2 + 18^2$ $PS = \sqrt{468}$ $= 21.6333$ cm Perimeter $= 12 + (21.6333 - 14.9769) + 10.5858$ $= 29.2422$ cm	1 1 1 1 1 1 1 1	**7**
6	(*a*) $r = \frac{\frac{1}{2}}{\frac{1}{4}}$ $= 2$ $T_n = 512$ $\left(\frac{1}{4}\right)(2)^{n-1} = 512$ $(2)^{n-1} = 2\,048$ $(2)^{n-1} = 2^{11}$ $n - 1 = 11$ $n = 12$	1 1 1	

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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(ii) $n = 15, p = 0.3, q = 0.7$ $P(X \geqslant 2) = 1 - P(X \leqslant 1)$ $= 1 - P(X = 0) - P(X = 1)$ $= 1 - {}^{15}C_0(0.3)^0(0.7)^{15-0} - {}^{15}C_1(0.3)^1(0.7)^{15-1}$ $= 1 - {}^{15}C_0(0.3)^0(0.7)^{15} - {}^{15}C_1(0.3)^1(0.7)^{14}$ $= 1 - 0.004748 - 0.03052$ $= 0.9647$	 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) $P(X \leqslant m) = 0.44$ $P\left(Z \leqslant \frac{m - 55}{14}\right) = 0.44$ $\frac{m - 55}{14} = -0.151$ $m - 55 = -2.114$ $m = 52.886$ kg	 1 1 1	**10**

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
9	(*a*) $\begin{array}{\|c\|c\|c\|c\|c\|c\|c\|c\|}\hline x & 2 & 4 & 6 & 8 & 10 & 12 & 14 \\ \hline y & 44.44 & 19.75 & 6.31 & 3.47 & 1.91 & 0.77 & 0.34 \\ \hline \log_{10} y & 1.65 & 1.30 & 0.80 & 0.54 & 0.28 & -0.11 & -0.47 \\ \hline \end{array}$  	1 3	
	(*b*) Salah catat di / *Wrongly recorded at* (6, 0.8) Koordinat betul / *Correct coordinates*: (6, 0.94) $\log_{10} y = 0.94$ $y = 10^{0.94}$ $y = 8.7096$	1	
	(*c*) (i) $y = \dfrac{p}{q^x}$ $y = pq^{-x}$ $\log_{10} y = \log_{10} p + \log_{10} q^{-x}$ $\log_{10} y = \log_{10} p - x \log_{10} q$ $\log_{10} y = (-\log_{10} q)x + \log_{10} p$ $Y = \quad m \quad X + \quad C$	1	

(*b*) Salah catat di / *Wrongly recorded at* (6, 0.8)
Koordinat betul / *Correct coordinates*: (6, 0.94)
$\log_{10} y = 0.94$
$y = 10^{0.94}$
$y = 8.7096$ — 1

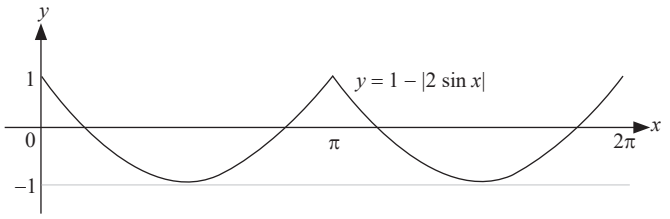
(*c*) (i) $y = \dfrac{p}{q^x}$
$y = pq^{-x}$
$\log_{10} y = \log_{10} p + \log_{10} q^{-x}$
$\log_{10} y = \log_{10} p - x \log_{10} q$
$\log_{10} y = (-\log_{10} q)x + \log_{10} p$
$Y = mX + C$ — 1
$\log_{10} p = 2.0$ — 1
$p = 10^{2.0}$ — 1
$p = 100$

(ii) $m = \dfrac{1.65 - 1.3}{2 - 4}$
$m = -0.175$
$-\log_{10} q = m$ — 1
$-\log_{10} q = -0.175$
$-\log_{10} q = m$
$q = 10^{0.175}$ — 1
$q = 1.4962$ — **10**

10

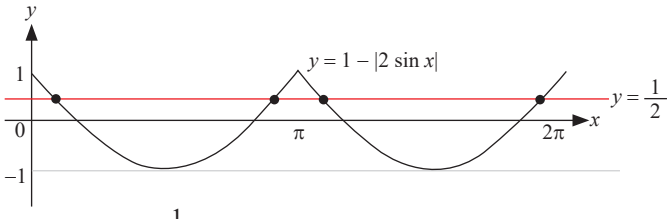
(*a*) $\dfrac{1 + \kos 2x}{\sin 2x} = \dfrac{1 + \kos^2 x - \sin^2 x}{2 \sin x \kos x}$ — 1
$= \dfrac{\kos^2 x + \sin^2 x + \kos^2 x - \sin^2 x}{2 \sin x \kos x}$ — 1
$= \dfrac{2 \kos^2 x}{2 \sin x \kos x}$ — 1
$= \dfrac{\kos x}{\sin x}$
$= \kot x$ (Ditunjukkan / *Shown*) — 1

(*b*) (i)



3

(ii)



1

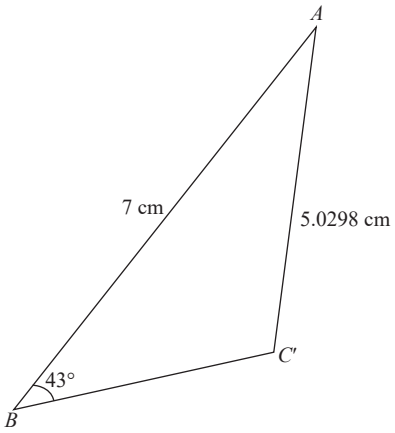
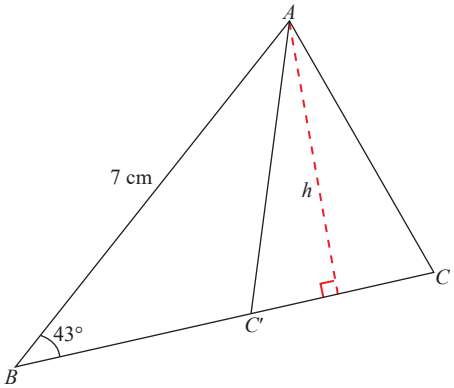
$|2 \sin x| + \dfrac{1}{2} = 1$
$\dfrac{1}{2} = 1 - |2 \sin x|$
$\dfrac{1}{2} = y$ — 1
Bilangan penyelesaian / *Number of solutions*: 4 — 1 — **10**

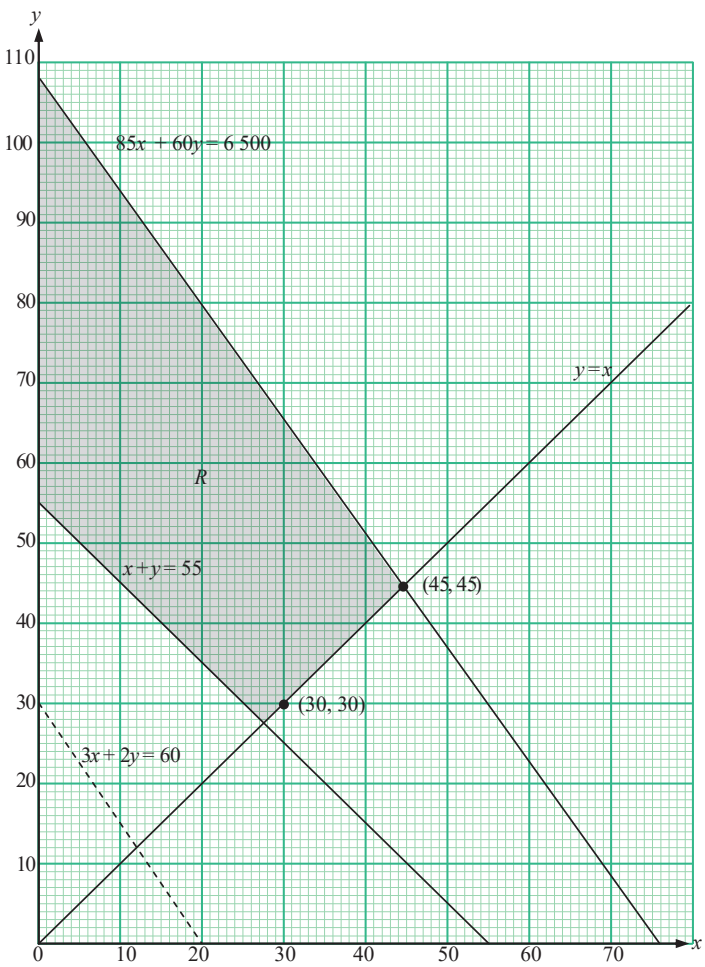
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
11	(*a*) $y = x^3 + x^2 - x + 5$ $\frac{dy}{dx} = 3x^2 + 2x - 1$ Fungsi kecerunan pada $S(-2, 3)$ / *Gradient function at* $S(-2, 3)$ $\frac{dy}{dx} = 3(-2)^2 + 2(-2) - 1$ $= 7$	1 1 1	
	(*b*) Kecerunan garisan normal / *Gradient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

Bahagian C

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
12	(*a*) Halaju maksimum / *Maximum velocity*: $a_P = 0$ $\frac{dv_P}{dt} = 0$ $2t - 1 = 0$	1	
	$t = \frac{1}{2}$	1	
	Apabila / *When* $t = \frac{1}{2}$; $v_P = \left(\frac{1}{2}\right)^2 - \left(\frac{1}{2}\right) - 6$ $= -6\frac{1}{4}$ m s^{-1}	1	
	(*b*) Halaju maksimum / *Maximum velocity*: $v_P = 0$ $t^2 - t - 6 = 0$ $(t + 2)(t - 3) = 0$	1	
	$t + 2 = 0$, $t - 3 = 0$ $t = -2$ (Abaikan / *Ignore*) $t = 3$ $s_P = \int (t^2 - t - 6)\, dt$ $= \frac{t^3}{3} - \frac{t^2}{2} - 6t + c$ Apabila / *When* $t = 0$, $s_P = 0$; $s_P = \frac{t^3}{3} - \frac{t^2}{2} - 6t + c$ $0 = \frac{(0)^3}{3} - \frac{(0)^2}{2} - 6(0) + c$ $0 = c$ $\therefore s_P = \frac{t^3}{3} - \frac{t^2}{2} - 6t$	1	
	Apabila / *When* $t = 3$; $s_P = \frac{(3)^3}{3} - \frac{(3)^2}{2} - 6(3)$ $s_P = -13\frac{1}{2}$ m	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 m – 21 m = 4 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) $\frac{1}{2}(7)(BC)\sin 43° = 16 \text{ unit}^2$ $BC = 6.703$	1 1	
	(ii) $AC^2 = 7^2 + (6.703)^2 - 2(7)(6.703)\cos 43°$ $AC^2 = 25.2985$ $AC = \sqrt{25.2985}$ $AC = 5.0298$ cm	1 1	
	(iii) $\frac{\sin \angle ACB}{7} = \frac{\sin 43°}{5.0298}$ $\sin \angle ACB = 0.9491$ $\angle ACB = \sin^{-1} 0.9491$ $= 71.64°$	1 1	
	(*b*) (i)  	1	
	(ii) $\angle AC'B = 180° - 71.64°$ $= 108.36°$	1	
	(iii)  		
	$\sin 43° = \frac{h}{7}$ $h = 7 \sin 43°$ $h = 4.774$ cm	1 1	**10**
15	(*a*) I $85x + 60y \leqslant 6\,500$ II $x + y \geqslant 55$ III $y \geqslant x$	1 1 1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) 	4	
	(*c*) (i) Bila $x = 30$, nilai minimum bagi $y = 30$. Maka, bilangan minimum rak kasut yang dibuat jika 30 buah rak buku yang dihasilkan ialah 30. *When* $x = 30$, *the minimum value of* $y = 30$. *Hence, the minimum number of shoe rack made if* 30 *of bookshelves made is* 30.	1	
	(ii) Keuntungan / *Profit* $= 30x + 20y$ Katakan / *Let* $30x + 20y = 600$ $3x + 2y = 60$ Untuk melukis garis lurus / *To draw straight line* $3x + 2y = 60$ x: 0, 20 y: 30, 0		
	Titik optimum ialah / *The optimal point is* (45, 45).	1	
	Keuntungan maksimum / *Maximum profit* = RM30(45) + RM20(45) = RM2 250	1	**10**

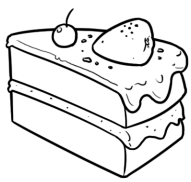
PEMBETULAN

KERTAS MODEL SIJIL PELAJARAN MALAYSIA SET 1

KERTAS 2 (SOALAN 5)

HALAMAN 101

5 Sebiji kek berbentuk silinder dengan tinggi 12 cm dibahagikan kepada 10 bahagian yang sama seperti yang ditunjukkan dalam Rajah 4.
A cylindrical cake with the height of 12 cm *is divided equally into* 10 *slices as shown in Diagram* 4.



Rajah 4
Diagram 4

(*a*) Diberikan perimeter bagi permukaan atas kek adalah sama dengan luas permukaan tersebut.
Cari panjang jejari, dalam cm, bagi kek itu. [4 *markah*]
Given the perimeter of the top surface of cake is equal to the surface area.
Find the length of radius, *in* cm, *of the cake*. [4 *marks*]

(*b*) Sepotong kek dijual pada harga RM4.90/100 g.
Jika Farhan memiliki RM180, berapakah potongan kek yang boleh dibeli? [4 *markah*]
A slice of cake is sold at the price of RM4.90/100 g.
If Farhan has RM180, *how many slices of cake can he buy*? [4 *marks*]
[Jisim sepotong kek = Isi padu sepotong kek ÷ 0.916]
[*Mass a slice of cake = Volume of a slice of cake* ÷ 0.916]

Jawapan / *Answer*:

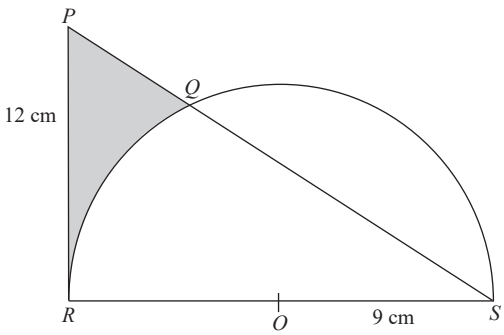
PEMBETULAN

KERTAS MODEL SIJIL PELAJARAN MALAYSIA SET 2

KERTAS 2 (SOALAN 5)

HALAMAN 136

5 Rajah 3 menunjukkan sebuah semibulatan yang berpusat di *O* dan segi tiga bersudut tegak *PRS*.
Diagram 3 *shows a semicircle with centre O and a right-angled triangle PRS.*



Rajah 3
Diagram 3

Diberi bahawa *PR* ialah 12 cm dan jejari bagi semi bulatan ialah 9 cm. Hitung perimeter bagi kawasan berlorek.
[Guna $\pi = 3.142$] [7 *markah*]
It is given that PR is 12 cm *and the radius of the semicircle is* 9 cm. *Calculate the perimeter of the shaded region*.
[*Use* $\pi = 3.142$] [7 *marks*]

Jawapan / *Answer*: