Pustaka Yakin Pelajar Sdn. Bhd.

KERTAS SOALAN PEPERIKSAAN SEBENAR SPM 2021

FORMAT TERKINI

+3 SET KERTAS MODEL FORMAT INSTRUMEN SPM TERKINI

MATEMATIK TAMBAHAN

KERTAS SOALAN PEPERIKSAAN SEBENAR *SPM 2021*

KERTAS 1

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

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

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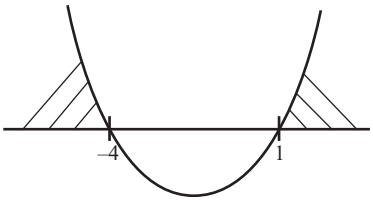
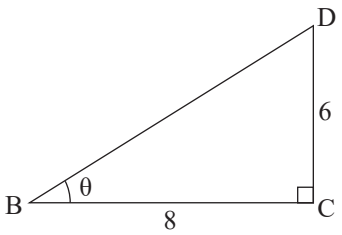
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
5	(*a*) $f(x) > 0$ $x^2 + 3x - 4 > 0$ $(x + 4)(x - 1) > 0$  $x < -4, x > 1$	1 1	
	(*b*) (i) $px + q - (x^2 + 3x - 4) = 0$ $-x^2 + (p - 3)x + q + 4 = 0$ $x^2 - (p - 3)x - q - 4 = 0$ $\alpha + \beta = p - 3$ $\alpha\beta = -q - 4$	 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	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 (*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 1 1	**6**
7	(*a*) $\lvert \overrightarrow{ED} + \overrightarrow{DB} + \overrightarrow{BE} \rvert = 0$ (*b*) $\overrightarrow{EC} = 11\underline{i} + 4\underline{i} + 10\underline{j}$ $= 15\underline{i} + 10\underline{j}$ (*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	**6**

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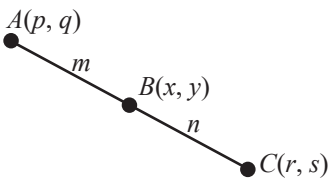
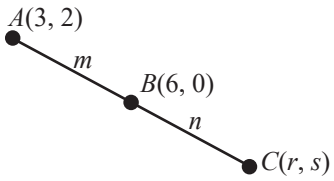
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
8	(*a*) 		
	$\frac{q-y}{y-s}=\frac{m}{n}$ $nq-ny=my-ms$ $ms+nq=(m+n)y$ $y=\frac{ms+nq}{m+n}$	1	
	$\frac{x+p}{r-x}=\frac{m}{n}$ $nx-np=mr-mx$ $(m+n)x=mr+np$ $x=\frac{mr+np}{m+n}$		
	$(x, y)=\left(\frac{mr+np}{m+n}, \frac{ms+nq}{m+n}\right)$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

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No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
9	(*a*) $g(x) = -3x^2 + 8x - 4$	1	
	(*b*) Kawasan berlorek/*Shaded area*		
	$= \int_1^2 (x^3 - 6x^2 + 12x - 6)dx - [-x^3 + 4x^2 - 4x]_1^2$	2	
	$= \left[\frac{x^4}{4} - \frac{6x^3}{3} + \frac{12x^2}{2} - 6x + x^3 - 4x^2 + 4x\right]_1^2$	1	
	$= \left[\frac{x^4}{4} - x^3 + 2x^2 - 2x\right]_1^2$		
	$= \left[\frac{2^4}{4} - 2^3 + 2(2)^2 - 2(2)\right] - \left[\frac{1}{4} - 1^3 + 2(1)^2 - 2(1)\right]$		
	$= \left(\frac{16}{4} - 8 + 8 - 4\right) - \left(\frac{1}{4} - 1 + 2 - 2\right)$		
	$= 0 - \left(-\frac{3}{4}\right)$		
	$= \frac{3}{4}$ unit^2	1	**5**
10	(*a*) $(x, x + 20, x + 40)$ mm	1	
	(*b*) $a = x$		
	$T_{72} = x + (72 - 1)(20)$		
	$= x + 1\,420$		
	$S_{72} = 55\,440$		
	$\frac{72}{2}(x + x + 1\,420) = 55\,440$	1	
	$2x + 1420 = \frac{55\,440}{36}$		
	$x = 60$	1	
	18 kepingan terakhir/*Last* 18 *terms*: T_{55}, T_{56}, ..., T_{72}		
	$S_{18} = \frac{18}{2}[2(60 + 30(20)) + (18 - 1)(20)]$	1	
	$= 14\,940$ mm	1	
	(*c*) **Cara 1/*Method* 1**		
	$60 + (72 - 1)(20) = 1\,480$		
	1 480		
	500 		
	$2\pi r = 1\,480$		
	$r = \frac{1\,480}{2}$		
	$= \frac{740}{\pi}$		
	$60 + (72 - 1)(20) = 1\,480$ dan/*and* $r = \frac{740}{\pi}$	1	

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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* $\frac{2\ \text{kad/}cards}{2\ \text{kad/}cards}$ $: \frac{15\ \text{atau/}or\ 17\ \text{atau/}or\ 19}{26\ \text{atau/}or\ 62} = 6$ cara/*ways* $: \frac{51\ \text{atau/}or\ 57\ \text{atau/}or\ 59}{62} = 3$ cara/*ways*	1	

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

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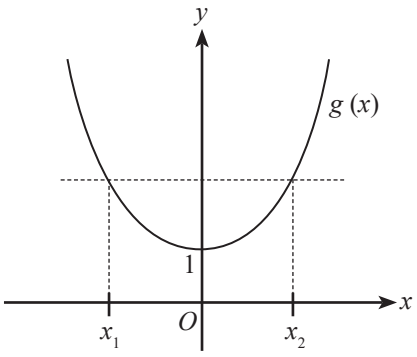
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
13	(*a*) $\frac{3}{4x-1}=\frac{1}{3}$	1	
	$x=\frac{5}{2}$	1	
	(*b*) $f(m+1)=3fg(p)$		
	$\frac{3}{4(m+1)-1}=3\left(\frac{3}{4p^2+3}\right)$	1	
	$3(4m+4-1)=4p^2+3$		
	$12m+9=4p^2+3$		
	$m=\frac{4p^2-6}{12}$		
	$=\frac{2p^2-3}{6}$	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	
	$4(2^{2x})+2^x-18=0$	1	
	$[4(2^x)+9][2^x-2]=0$		
	$4(2^x)+9=0$		
	$2^x=-\frac{9}{4}$		
	$2x>0$		
	$2x=-\frac{9}{4}$ (tidak mungkin/*not possible*)		
	$2^x-2=0$		
	$2^x=2$		
	$x=1$	1	

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

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KERTAS 2

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 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.* (*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*	Markah Total *Total Marks*
3	(*a*) $gf(x) = 3x - 4$, $f(x) = x + 2$ $g(x + 2) = 3x - 4$ $f^{-1}(x) = y$ $f(y) = x$ $y + 2 = x$ $y = x - 2$ $f^{-1}(x) = x - 2$ $g(x) = gf[f^{-1}(x)]$ $= 3(x - 2) - 4$ $= 3x - 10$ (*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 1 1 1	**7**
4	(*a*) $f(x) = (x - 3)^2 + k$ $f(0) = 5$ $(0 - 3)^2 + k = 5$ $9 + k = 5$ $k = -4$ (*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 1 1 1	**7**

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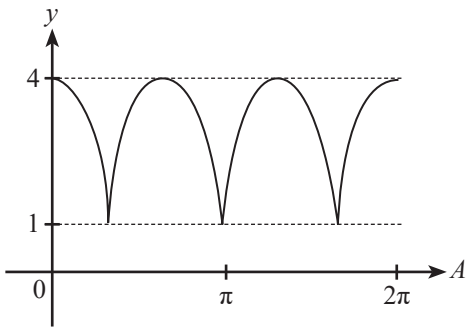
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
5	(*a*) (i) $2\,\text{kot}^2 A \sin^2 A = 2\left(\frac{\text{kos}^2 A}{\sin^2 A}\right)\sin^2 A$ $= 2\,\text{kos}^2 A$ $= (2\,\text{kos}^2 A - 1) + 1$ $= 1 + \text{kos}\,2A$	1 1	
	$2\cot^2 A \sin^2 A = 2\left(\frac{\cot^2 A}{\sin^2 A}\right)\sin^2 A$ $= 2\cot^2 A$ $= (2\cot^2 A - 1) + 1$ $= 1 + \cot 2A$		
	(ii) $2\,\text{kot}^2 A \sin^2 A = \frac{1}{2}$ $1 + \text{kos}\,2A = \frac{1}{2}$ $\text{kos}\,2A = -\frac{1}{2}$ $\alpha = \text{kos}^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{3}$	1 1	
	$2\cot^2 A \sin^2 A = \frac{1}{2}$ $1 + \cos 2A = \frac{1}{2}$ $\cos 2A = -\frac{1}{2}$ $\alpha = \cos^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{3}$ $2A = \pi - \frac{\pi}{3}, \pi + \frac{\pi}{3}$ $A = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$	1	
	(*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*) $\frac{dy}{dx} = 2x - 2$ $y = \int(2x - 2)dx$ $= \frac{2x^2}{2} - 2x + c$ $x = -2, y = -7$ $-7 = (-2)^2 - 2(-2) + c$ $c = -15$ $y = x^2 - 2x - 15$ (*b*) $y = (x + 1)^2 - 2(x + 1) - 15$ $= x^2 + 2x + 1 - 2x - 2 - 15$ $= x^2 - 16$ $x^2 = y + 16$ $V = \pi\int_{-16}^{0}(y + 16)dy$ $= \pi\left[\frac{y^2}{2} + 16y\right]_{-16}^{0}$ $= \pi\left[\frac{0^2}{2} + 16(0)\right] - \pi\left[\frac{(-16)^2}{2} + 16(-16)\right]$ $= 128\pi$	 1 1 1 1 1 1 1	**7**
8	(*a*) (i) $A = (26 - 2x)(x)$ $= 26x - 2x^2$ (ii) $\frac{dA}{dx} = 0$ $26 - 4 = 0$ $x = 6.5$ cm $A_{\text{maksimum/}maximum} = 26(6.5) - 2(6.5)^2$ $= 84.5$ cm^2	 1 1 1 1	

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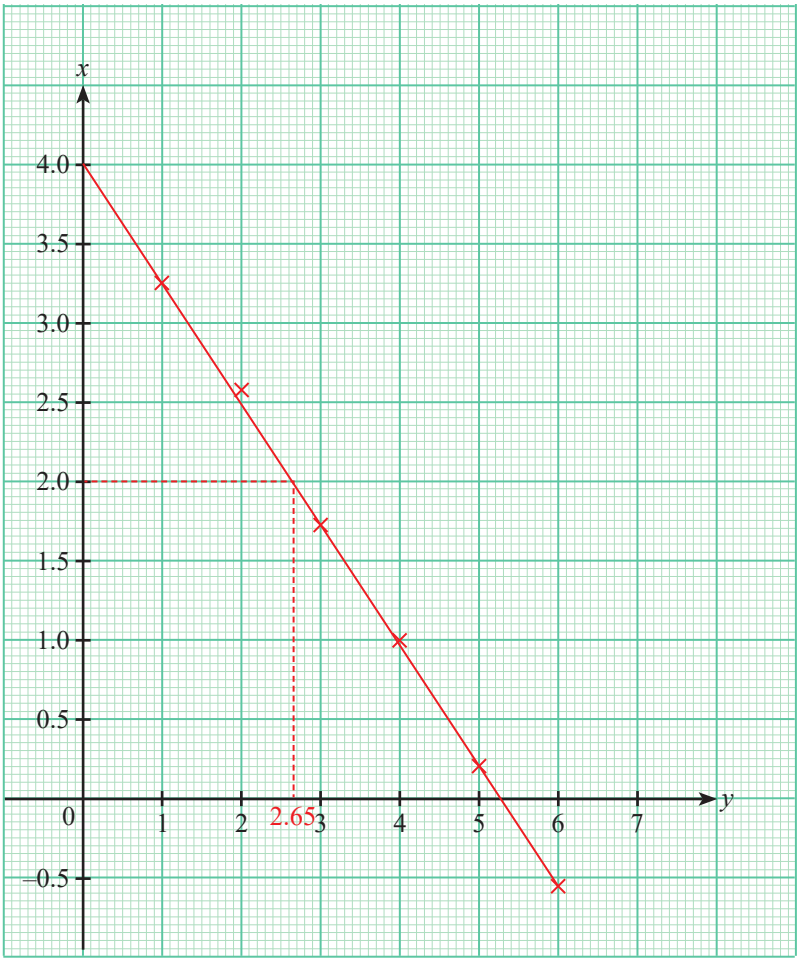
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) $\frac{dA}{dt} = 36 \text{ cm}^2 \text{ s}^{-1}, x = \sqrt{5}$ $\frac{dA}{dt} = \frac{dA}{dx} \times \frac{dx}{dt}$ $36 = \left[26 - 4\left(\sqrt{5}\right)\right] \times \frac{dx}{dt}$	2	
	$\frac{dx}{dt} = 2.11 \text{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

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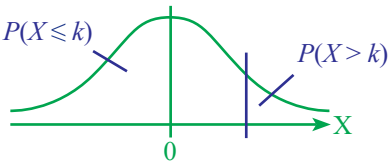
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) (i) $y^2 = \frac{4}{x^2}$ $x^2 y^2 = 4$ $(xy)^2 = 4$ $xy = 2$ $x = 2.65$	1	
	(ii) $y + \sqrt{h} = \frac{k^2}{x}$ $xy + x\sqrt{h} = k^2$ $xy = (-\sqrt{h})\,x + k^2$	1	
	$m = \frac{4-1}{0-4}$ $= -\frac{3}{4}$ $m = -\sqrt{h}$	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) $n = 10, p = \frac{1}{3}, q = \frac{2}{3}, r > 2$ $P(X > 2) = 1 - P(X \leq 2)$ $= 1 - P(X = 0) - P(X = 1) - P(X = 2)$ $= 1 - {}^{10}C_0\left(\frac{1}{3}\right)^0\left(\frac{2}{3}\right)^{10} - {}^{10}C_1\left(\frac{1}{3}\right)^1\left(\frac{2}{3}\right)^9 - {}^{10}C_2\left(\frac{1}{3}\right)^2\left(\frac{2}{3}\right)^8$ $= 1 - 0.0173 - 0.0867 - 0.1951$ $= 0.7009$	1 1	
	(*b*) $P(x > k) = \frac{1}{4}[P(X \leq k)]$  		

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**
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) $s_A = \int (24t - 4t^2 - 20)\, dt$ $= \frac{24t^2}{2} - \frac{4t^3}{3} - 20t + c$ $t = 0, s_A = 0$ $0 = 12(0)^2 - \frac{4}{3}(0)^3 - 20(0) + c$ $c = 0$ $s_A = 12t^2 - \frac{4}{3}t^3 - 20t$ $s_B = \int (24t - 25) dt$ $= \frac{24t^2}{2} - 25t + c$ $t = 0, s_B = 0$ $0 = 12(0)^2 - 25(0) + c$ $c = 0$ $s_B = 12t^2 - 25t$	1	
	$s_A = s_B$ $12t^2 - \frac{4}{3}t^3 - 20t = 12t^2 - 25t$ $-\frac{4}{3}t^3 + 5t = 0$ $-t\left(\frac{4}{3}t^2 - 5\right) = 0$ $\frac{4}{3}t^2 = 5$ $t = \sqrt{\frac{15}{4}}$ $= 1.936$ s	1 1	

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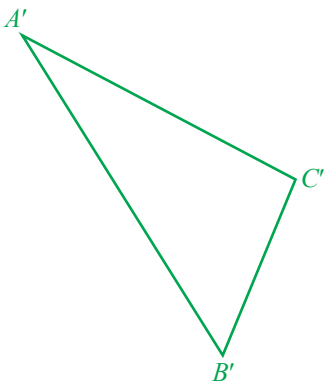
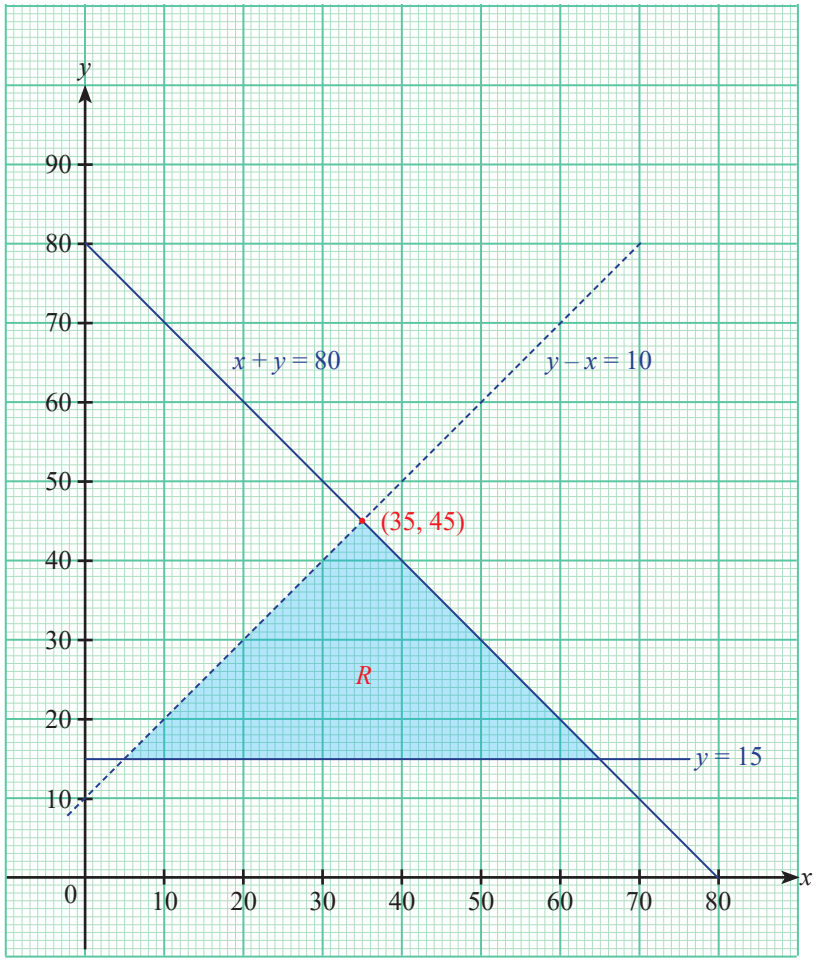
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(ii) $v_A = 0$ $24t - 4t^2 - 20 = 0$ $t^2 - 6t + 5 = 0$ $(t-1)(t-5) = 0$ $t = 1$ s, 5 s $s = \left\lvert \int_0^1 (24t - 4t^2 - 20)dt \right\rvert + \int_1^5 (24t - 4t^2 - 20)dt$ $= \left\lvert \left[12t^2 - \frac{4}{3}t^3 - 20t\right]_0^1 \right\rvert + \left[12t^2 - \frac{4}{3}t^3 - 20t\right]_1^5$ $= \left\lvert \left[12(1)^2 - \frac{4}{3}(1)^3 - 20(1)\right] - \left[12(0)^2 - \frac{4}{3}(0)^3 - 20(0)\right] \right\rvert +$ $\left[\left[12(5)^2 - \frac{4}{3}(5)^3 - 20(5)\right] - \left[12(1)^2 - \frac{4}{3}(1)^3 - 20(1)\right]\right]$ $= \frac{28}{3} + \frac{128}{3}$ $= 52$ m	1 1 1 1	**10**
13	(*a*) (i) $x = 80$ (ii) $\frac{2.00}{y} \times 100 = 80$ $y = \text{RM}2.50$ (*b*) $\bar{I}_{20/18} = \frac{108 \times 60 + 104 \times 35 + 80 \times 5}{100}$ $= 105.20$ (*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 2 1 1 1 1 1	**10**
14	(*a*) (i) $\frac{1}{2}(2.8)(3)\sin 143° = \frac{1}{2}(3)(3.6)\sin \angle BCD$ $\angle BCD = 152.09°$ (ii) $AC^2 = 2.8^2 + 3^2 - 2(2.8)(3)\,\text{kos}/cos\ 143°$ $AC = 5.50$ cm $CE = 5.50 - 4 = 1.50$ cm (iii) $\frac{2.8}{\sin \angle BCA} = \frac{5.50}{\sin 143°}$ $\sin \angle BCA = 0.3064$ $\angle BCA = 17.84°$ $BE^2 = 3^2 + 1.5^2 - 2(3)(1.5)\,\text{kos}/cos\ 143°$ $BE = 1.64$ cm	1 1 1 1 1 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 : $x + y \leqslant 80$	1	
	II : $y - x < 10$	1	
	III : $y \geqslant 15$	1	
	(*b*) 	3	

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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**

KERTAS MODEL SPM SET 1

KERTAS 1

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

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

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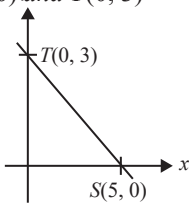
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
5	(*a*) $d = 9 - 5$ $= 4$ (*b*) $a = 5, d = 4$ $T_n = a + (n-1)d$ $T_{20} = 5 + 19(4)$ $= 81$ (*c*) $S_{12} - S_4 = \frac{12}{2}[2(5) + 11(4)] - \frac{4}{2}[2(5) + 3(4)]$ $= 324 - 44$ $= 280$	6	**6**
6	(*a*) $p = 0.6, q =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

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

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No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) Titik tengah garis lurus, *M* *The midpoint of the straight line, M* $= \left(\frac{5}{2}, \frac{3}{2}\right)$ $\therefore y = \frac{5}{3}x + c$ $\frac{3}{2} = \frac{5}{3}\left(\frac{5}{2}\right) + c$ $c = \frac{3}{2} - \frac{25}{6}$ $= -\frac{8}{3}$ $\therefore y = \frac{5}{3}x - \frac{8}{3}$	5	**5**
11	(*a*) $s = \int v\, dt$ $= \int (15 + 2t - t^2)\, dt$ $= 15t + t^2 - \frac{t^3}{3} + c$ Pada $c = 0$, $s = 15t + t^2 - \frac{t^3}{3}$ *At* $c = 0$, $s = 15t + t^2 - \frac{t^3}{3}$ Apabila $t = 5$, *When* $t = 5$, $s = 15(5) + 5^2 - \frac{5^3}{3}$ $= 58\frac{1}{3}$ m (*b*) Apabila zarah bergerak ke arah kanan, $v > 0$. *When the particle moves to the right,* $v > 0$. $15 + 2t - t^2 > 0$ $(t - 5)(t + 3) > 0$ $t < -3$ atau / *or* $t > 5$ Oleh sebab $t \geq 0$, zarah bergerak ke kanan apabila $t > 5$. *Since* $t \geq 0$, *the particle moves to the right when* $t > 5$.	6	**6**
12	(*a*) $m = \frac{26 - 1}{6 - 1}$ $= \frac{25}{5}$ $= 5$ $\therefore \frac{y}{x} = 5\left(\frac{1}{x^2}\right) + c$ Pada (1, 1), *At* (1, 1), $1 = 5(1) + c$ $c = -4$ $\therefore \frac{y}{x} = 5\left(\frac{1}{x^2}\right) - 4$		

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	Apabila $\frac{y}{x} = 4$, *When* $\frac{y}{x} = 4$, $4 = 5\left(\frac{1}{x^2}\right) - 4$ $8 = 5\left(\frac{1}{x^2}\right)$ $8x^2 = 5$ $x^2 = \frac{5}{8}$ $x = \sqrt{\frac{5}{8}}$ (*b*) $y = \frac{a}{x} + bx$ $\frac{y}{x} = \frac{a}{x^2} + b$ $\frac{y}{x} = \frac{5}{x^2} - 4$ $\therefore a = 5, b = -4$	5	**5**
13	(*a*) $h = 2.5r$; $V = \pi r^2 h$ $= \pi r^2(2.5r)$ $= 2.5\,\pi r^3$ $\frac{dV}{dr} = 7.5\,\pi r^2$ $= 456.3\pi$ $\frac{dV}{dt} = \frac{dV}{dr} \times \frac{dr}{dt}$ $2.3 = 456.3\pi \times \frac{dr}{dt}$ $\frac{dr}{dt} = 1.604 \times 10^{-3}$ cm s^{-1} (*b*) $y = kx^3 + 6x^2 + 7x$ $\frac{dy}{dx} = 3kx^2 + 12x + 7$ $x = 3, \frac{dy}{dx} = 3k(3)^2 + 12(3) + 7$ $= 27k + 43$ $x = 5, \frac{dy}{dx} = 3k(5)^2 + 12(5) + 7$ $= 75k + 67$ $27k + 43 = 75k + 67$ $48k = -24$ $k = -\frac{1}{2}$	4 4	**8**

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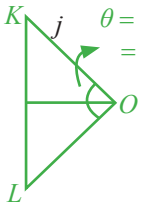
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
14	(*a*)  $\sin\theta = \dfrac{j}{\left(\frac{KL}{2}\right)}$ $KL = \dfrac{2j}{\sin\theta}$ Perimeter tembereng *KL*/*Perimeter of segment KL* = 41.3 $S_{KL} + KL = 41.3$ $j(0.67\pi) + \dfrac{2j}{\sin 120.6°} = 41.3$ $4.428j = 41.3$ $j = 9.326$ cm Perimeter kawasan berlorek/*Perimeter of the shaded region* $= KL + S_{\text{major } KL}$ $= \dfrac{2(9.326)}{\sin 120.6°} + 9.326(2\pi - 0.67\pi)$ = 60.637 cm	4	
	(*b*) $\angle XOY = 3.142 - 0.531 - \left(53 \times \dfrac{3.142}{180}\right)$ = 1.686 rad Luas segmen/*Area of the segment* $= \dfrac{1}{2} r^2 (\theta - \sin\theta)$ $= \dfrac{1}{2} (15.7)^2 (1.686 - \sin 1.686)$ = 85.36 cm^2	4	**8**
15	(*a*) $x = y + 5$ ..... ① $\quad y^2 = 7x^2 - 9$ ..... ② Gantikan ① ke dalam ② *Substitute* ① *into* ② $y^2 = 7(y + 5)^2 - 9$ $y^2 = 7(y^2 + 10y + 25) - 9$ $y^2 = 7y^2 + 70y + 175 - 9$ $0 = 6y^2 + 70y + 166$ $y = \dfrac{-70 \pm \sqrt{70^2 - 4(6)(166)}}{2(6)}$ = –3.311 atau / *or* –8.355 Gantikan $y = -3.311$ ke dalam ① *Substitute* $y = -3.311$ *into* ① $x = -3.311 + 5$ = 1 689 Gantikan $y = -8.355$ ke dalam ① *Substitute* $y = -8.355$ *into* ① $x = -8.355 + 5$ = –3.355	4	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*

	(*b*) $2p + q - 3r = 7$ ..... ①
	$p - 5q - 2r = 9$ ..... ②
	$3p - 4q + 6r = 12$ ..... ③
	② × 2 : $2p - 10q - 4r = 18$ ..... ④
	① – ④ : $11q + r = -11$
	$r = -11 - 11q$ ..... ⑤
	① × 3 : $6p + 3q - 9r = 21$ ..... ⑥
	③ × 2 : $6p - 8q + 12r = 24$ ..... ⑦
	⑥ – ⑦ : $11q - 21r = -3$ ..... ⑧
	Gantikan ⑤ ke dalam ⑧
	Substitute ⑤ *into* ⑧
	$11q - 21(-11 - 11q) = -3$
	$11q + 231 + 231q = -3$
	$242q = -234$
	$q = -0.9669 \text{ // } -\frac{117}{121}$
	Gantikan $q = -0.9669 \text{ // } -\frac{117}{121}$ ke dalam ⑤
	Substitute $q = -0.9669 \text{ // } -\frac{117}{121}$ *into* ⑤
	$r = -11 - 11(-0.9669)$
	$= -0.3641 \text{ // } -\frac{4}{11}$
	Gantikan $q = -0.9669 \text{ // } -\frac{117}{121}$ dan $r = -0.3641 \text{ // } -\frac{4}{11}$ ke dalam ②
	Substitute $q = -0.9669 \text{ // } -\frac{117}{121}$ *and* $r = -0.3641 \text{ // } -\frac{4}{11}$ *into* ②
	$p - 5(-0.9669) - 2(-0.3641) = 9$
	$p + 5.5627 = 9$
	$p = 3.4373 \text{ // } \frac{416}{121}$
		4	**8**

KERTAS 2

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

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No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) $6^x y = \frac{x+y}{6^y} \cdot x$ $6^x \cdot 6^y = \frac{x+y}{y} \cdot x$ $6^{x+y} = \frac{2x}{y}$ $36 = \frac{2x}{y}$ $x = 18y$ ..... ① $x + y = 2$ ..... ② Gantikan ① ke dalam ② *Substitute* ① *into* ② $18y + y = 2$ $19y = 2$ $y = \frac{2}{19}$ $x = 18\left(\frac{2}{19}\right) = \frac{36}{19}$	3	**6**
2	(*a*) $\frac{AC}{\sin 50°} = \frac{7.1}{\sin 80°}$ $\quad \frac{CD}{\sin 60°} = \frac{6.4}{\sin 40°}$ $AC = 5.523$ cm $\quad CD = 8.623$ cm Panjang *ACD* *Length of ACD* = 5.523 cm + 8.623 cm = 14.146 cm (*b*) $\frac{ED}{\sin 80°} = \frac{6.4}{\sin 40°}$ $ED = 9.805$ cm (*c*) Luas segi tiga *ABC* *Area of triangle ABC* $= \frac{1}{2}(7.1)(5.523)\sin 50°$ $= 15.0196$ cm^2 Luas segi tiga *CDE* *Area of triangle CDE* $= \frac{1}{2}(6.4)(9.805)\sin 60°$ $= 27.1724$ cm^2 Jumlah luas *Total area* = 15.0196 cm^2 + 27.1724 cm^2 = 42.192 cm^2	3 1 4	**8**

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

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

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

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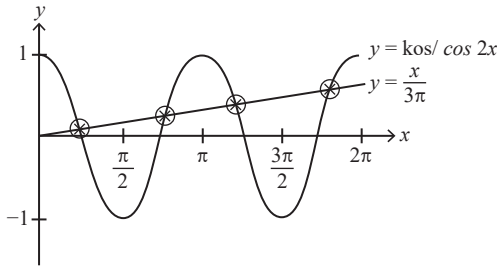
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
8	(*a*) $y + x^2 = 16$ Pada/*At* $x = 0$, $y + 0 = 16$ $y = 16$ $\therefore D(0, 16)$ $y + x^2 = 16$ $y = -x^2 + 16$ $\frac{dy}{dx} = -2x$ $= -2(2)$ $= -4$ Persamaan tangen: *Equation of tangent:* $y - y_1 = \frac{dy}{dx}(x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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*c*) Isi padu janaan *The generated volume* $= \int_{12}^{16} \pi x^2 \, dy$ $= \pi \int_{12}^{16} (16 - y) \, dy$ $= \pi \left[16y - \frac{y^2}{2} \right]_{12}^{16}$ $= \pi \left[\left[16(16) - \frac{16^2}{2} \right] - \left[16(12) - \frac{12^2}{2} \right] \right]$ $= \pi (128 - 120)$ $= 8\pi$ unit^3/*units*^{3}	3	**10**
9	(*a*) Sebelah kanan *Right-hand side* $= \text{kos}/cos\ 2x$ $= 2\,\text{kos}^2/cos^2\ x - 1$ $= \frac{2}{1 + \tan^2 x} - 1$ $= \frac{2 - 1 - \tan^2 x}{1 + \tan^2 x}$ $= \frac{1 - \tan^2 x}{1 + \tan^2 x}$ = Sebelah kiri/*Left-hand side* $\text{sek}^2/sec^2\ x = 1 + \tan^2 x$ $\frac{1}{\text{kos}^2/\ cos^2\ x} = 1 + \tan^2 x$ $\text{kos}^2/\ cos^2\ x = \frac{1}{1 + \tan^2 x}$	3	
	(*b*) & (*c*)		

x	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3\pi}{4}$		$\frac{5\pi}{4}$	$\frac{3\pi}{2}$	$\frac{7\pi}{4}$	2
y	1	0	–1	0	1	0	–1	0	1



3

$3\pi(1 - \tan^2 x) = x(1 + \tan^2 x)$

$\frac{1 - \tan^2 x}{1 + \tan^2 x} = \frac{x}{3\pi}$

$\text{kos}/cos\ 2x = \frac{x}{3\pi}$

$y = \frac{x}{3\pi}$

x	0	$\frac{\pi}{4}$	$\frac{3\pi}{4}$	$\frac{5\pi}{4}$	$\frac{7\pi}{4}$
y	0	0.083	0.25	0.417	0.583

∴ Bilangan penyelesaian/*Number of solutions* = 4

4 | **10**

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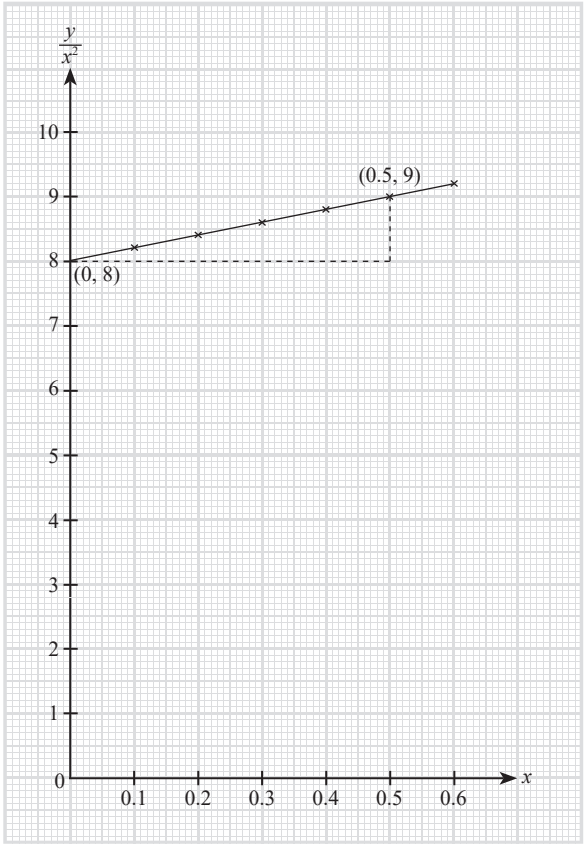
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
10	(*a*) $\begin{array}{\|c\|c\|c\|c\|c\|c\|c\|}\hline x & 0.1 & 0.2 & 0.3 & 0.4 & 0.5 & 0.6 \\ \hline \frac{y}{x^2} & 8.2 & 8.4 & 8.6 & 8.8 & 9.0 & 9.2 \\ \hline\end{array}$  (*b*) $y = px^3 + qx^2$ $\div 2 : \frac{y}{x^2} = px + q$ Pintasan-*y*/*y-intercept* = 8 Kecerunan/*Gradient*, $p = \frac{9-8}{0.5-0}$ $= \frac{1}{0.5}$ $= 2$ $p = 2, q = 8$ (*c*) $y = px^3 + qx^2$ $= 2x^3 + 8x^2$ Apabila/*When* $x = 0.73$, $y = 2(0.73)^3 + 8(0.73)^2$ $= 5.041$	3 5 2	**10**

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

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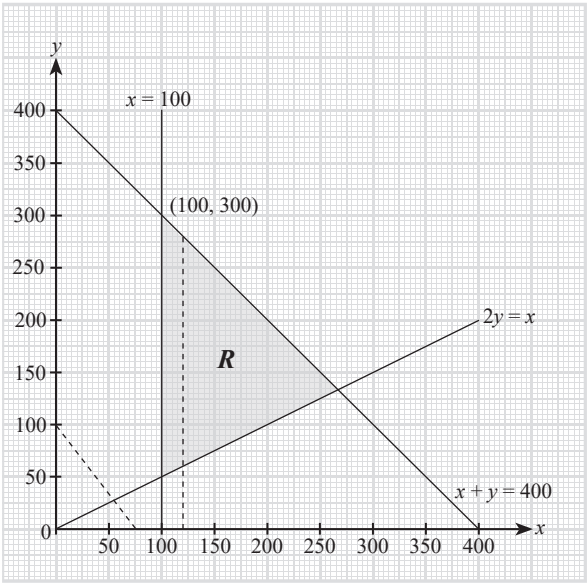
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*)  (*c*) (i) Apabila/*When* $x = 120$, $60 \le y \le 280$ (ii) $70x + 50y = k$ Katakan/*Let* $k = 5\,000$ $70x + 50y = 5\,000$ $7x + 5y = 500$ Jumlah maksimum yuran bulanan *Maximum total monthly fees* $= 70(100) + 50(300)$ = RM22 000	4 3	**10**
13	(*a*) $x = 114$ (*b*) Biarkan/*Let* Q_0 = Harga pada tahun 2021 *Price in the year* 2021 Q_1 = Harga pada tahun 2022 *Price in the year* 2022 Nombor indeks/*Index number*, $I = \frac{Q_1}{Q_0} \times 100$ $110 = \frac{91.50}{Q_0} \times 100$ Q_0 = RM83.18 (*c*) $I_{2023/2022} = \frac{I_{2023/2021}}{I_{2022/2021}} \times 100$ $= \frac{129}{121} \times 100$ $= 106.61$	1 2 3	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*d*) (i) Indeks gubahan/*Composite index*, $I = \frac{\sum I_i w_i}{\sum w_i}$ $111.3 = \frac{150y + 110(4) + 114(3) + 121(1)}{y + 4 + 3 + 1}$ $111.3 = \frac{105y + 903}{y + 8}$ $111.3y + 890.4 = 105y + 903$ $6.3y = 12.6$ $y = 2$ (ii) $I = \frac{Q_{2022}}{Q_{2021}} \times 100$ $111.3 = \frac{Q_{2022}}{92.50} \times 100$ $Q_{2022} = \text{RM}102.95$	4	**10**
14	(*a*) Halaju minimum/*Minimum velocity*, $\frac{dv}{dt} = 0$ $2t - 5 = 0$ $t = 2.5$ Oleh sebab $\frac{d^2v}{dt^2} = 2(> 0)$, v adalah minimum apabila $t = 2.5$ *Since* $\frac{d^2v}{dt^2} = 2(> 0)$, *v is minimum when* $t = 2.5$ Maka, halaju minimum zarah *Hence, minimum velocity of the particle* $= (2.5)^2 - 5(2.5) + 6$ $= -0.25 \text{ m s}^{-1}$	3	
	(*b*) $t = 0, \quad t^2 - 5t + 6 = 0$ $(t - 3)(t - 2) = 0$ $\therefore t = 3, t = 2$ Jarak antara titik A dan B *Distance between points A and B* $= \int_2^3 (t^2 - 5t + 6)\, dt$ $= \left[\frac{t^3}{3} - \frac{5t^2}{2} + 6t\right]_2^3$ $= \left[\frac{3^3}{3} - \frac{5(3)^2}{2} + 6(3)\right] - \left[\frac{2^3}{3} - \frac{5(2)^2}{2} + 6(2)\right]$ $= \left\lvert \frac{9}{2} - \frac{14}{3} \right\rvert$ $= \left\lvert -\frac{1}{6} \right\rvert$ $= 0.167 \text{ m}$	3	

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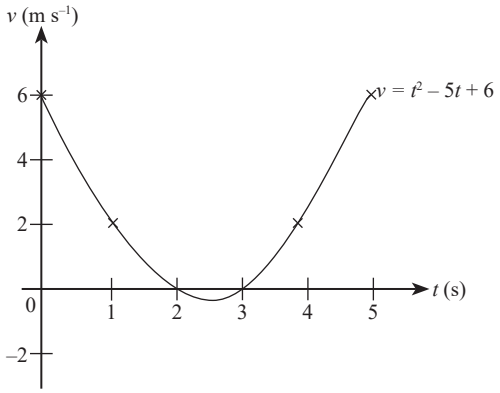
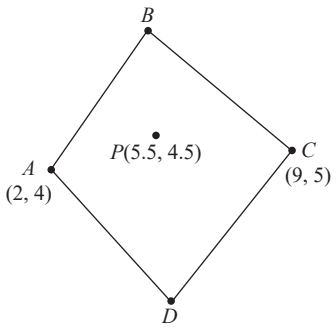
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*c*) $\begin{array}{\|c\|c\|c\|c\|c\|c\|c\|c\|}\hline \boldsymbol{t} & 0 & 1 & 2 & 2.5 & 3 & 4 & 5 \\ \hline \boldsymbol{v} & 6 & 2 & 0 & -0.25 & 0 & 2 & 6 \\ \hline \end{array}$  (*d*) $t > 2.5$	3 1	**10**
15	(*a*) $m_{AC} = \dfrac{5-4}{9-2}$ $= \dfrac{1}{7}$ $m_2 = -7$ Titik tengah *AC* *Midpoint AC* $= \left(\dfrac{9+2}{2}, \dfrac{5+4}{2}\right)$ $= (5.5, 4.5)$ Persamaan pembahagi dua sama serenjang bagi *AC* *Equation of the perpendicular bisector of AC* $\dfrac{y-4.5}{x-5.5} = -7$ $y = -7(x - 5.5) + 4.5$ $y = -7x + 43$ (*b*) *BD* ialah pembahagi dua sama serenjang bagi *AC*. *BD is the perpendicular bisector of AC.* Persamaan *BD* ialah/*The equation of BD is* $y = -7x + 43; \quad m = -7$ $\dfrac{y-4}{x-5} = -7$ $y = -7(x - 5) + 4$ $= -7x + 39$	 2 3	

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

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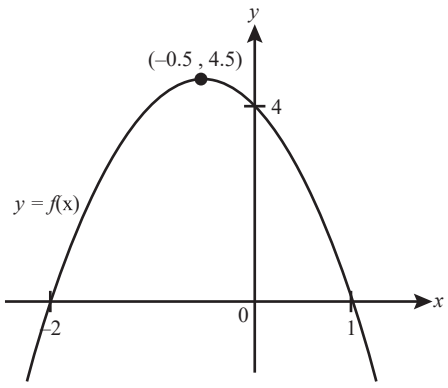
KERTAS 1

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

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No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
4	$y = x^3$ ..... ① $y + \delta y = (x + \delta x)^3$ ..... ② ② – ① : $\delta y = (x + \delta x)^3 - x^3$ $= (x + 8x)[x^2 + 2x\delta x + (\delta x)^2] - x^3$ $= x^3 + 2x^2\delta x + x(\delta x)^2 + x^2\delta x + 2x(\delta x)^2 + (\delta x)^3 - x^3$ $= 3x^2\delta x + 3x(\delta x)^2 + (\delta x)^3$ $\frac{\delta y}{\delta x} = 3x^2 + 3x(\delta x) + (\delta x)^2$ $\frac{dy}{dx} = \lim_{\delta x \to 0} [3x^2 + 3x(\delta x) + (\delta x)^2]$ $= 3x^2$ $\delta y = 3(3)^2 \times (-0.02)$ $= -0.54$	5	**5**
5	**5**(*a*): Ada *Yes* — Garis mengufuk memotong satu titik sahaja pada graf. *Horizontal line cuts the graph at only one point.* **5**(*b*): Ada *Yes* — Garis mengufuk memotong satu titik sahaja pada graf. *Horizontal line cuts the graph at only one point.* **5**(*c*): Tiada *No* — Garis mengufuk memotong lebih daripada satu titik pada graf. *Horizontal line cuts the graph at more than one point.*	3	**3**
6	sek/*sec* A(tan A + kot/*cot* A) $= \frac{1}{\text{kos/}cos\ A}\left(\frac{\sin A}{\text{kos/}cos\ A} + \frac{\text{kos/}cos\ A}{\sin A}\right)$ $= \frac{1}{\text{kos/}cos\ A}\left(\frac{\sin^2 A + \text{kos/}cos^2\ A}{\sin A\ \text{kos/}cos\ A}\right)$ $= \frac{1}{\text{kos/}cos\ A}\left(\frac{1}{\sin A\ \text{kos/}cos\ A}\right)$ $= \frac{1}{\sin A\ (1 - \sin^2 A)}$ $= \frac{1}{\sin A \sin^3 A}$	4	**4**
7	(*a*) $\frac{7\sqrt{5}}{\sqrt{5} - 14} \times \frac{\sqrt{5} + 14}{\sqrt{5} + 14}$ $= \frac{35 + 98\sqrt{5}}{5 - 14^2}$ $= \frac{35 + 98\sqrt{5}}{-191}$	3	

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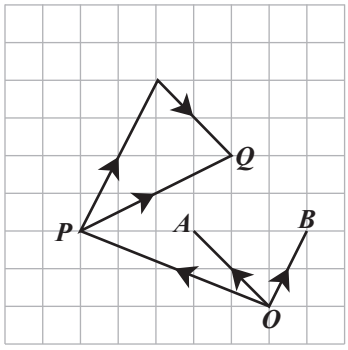
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) $9(27^x) = 3^y$ $3^2(3^{3x}) = 3^y$ $3^{2+3x} = 3^y$ $y = 3x + 2$ ..... ① $\log_2 y - \log_2 (x-1) = 1$ $\log_2 \frac{y}{x-1} = 1$ $\frac{y}{x-1} = 2$ $y = 2x - 2$ ..... ② ① – ② : $0 = x + 4$ $0 = x + 4$ $x = -4$ $y = 3(-4) + 2$ $= -10$ $x = -4, y = -10$	4	**7**
8	(*a*) $a + 2d = x$ ..... ① $a + 6d = y$ ..... ② ② – ① : $4d = y - x$ $d = \frac{y-x}{4}$ $a = x - 2\left(\frac{y-x}{4}\right)$ $= \frac{3}{2}x - \frac{1}{2}y$	3	
	(*b*) $n = 2029 - 2022 + 1 = 8$ $T_{2030}(T_8) = 10\,000 \times 1.04^{8-1}$ = RM13 159.32 $n = 2039 - 2029 + 1 = 11$ $T_{2040}(T_{11}) = 13\,159.32 \times 1.05^{11-1}$ = RM21 435.15	4	**7**
9	$y = kx^3$ $\log_2 y = 3 \log_2 x + \log_2 k$ $\log_2 k = -1$ $k = \frac{1}{2}$ $\frac{h-(-1)}{2-0} = 3$ $h = 5$	4	**4**
10	(*a*) (i) 		

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

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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) (i) gf (ii) $f(x) = 2x - 1$ $f^{-1}(x) = \frac{x+1}{2}$ (iii) $g(x) = \frac{2 - 2\left(\frac{x+1}{2}\right)}{2\left(\frac{x+1}{2}\right) - 1}$ $= \frac{1-x}{x}$; $x \neq 0$	4	**8**

KERTAS 2

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
1	(*a*) $3x^2 + 2x - 6 = 0$ $\alpha + \beta = -\frac{2}{3}$ $\quad \alpha\beta = -2$ $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta}$ $= \frac{(\alpha+\beta)^2 - 2\alpha\beta}{\alpha\beta}$ $= \frac{\left(-\frac{2}{3}\right)^2 - 2(-2)}{-2}$ $= -\frac{20}{9}$ $\frac{\alpha}{\beta} \times \frac{\beta}{\alpha} = 1$ $x^2 - \left(-\frac{20}{9}\right)x + (1) = 0$ $9x^2 + 20x + 9 = 0$	3	
	(*b*) $x^2 + (3k-1)x + 2k + 10 = 0$ di mana / *where* $a = 1$, $b = 3k - 1$, $c = 2k + 10$ $(3k-1)^2 - 4(1)(2k+10) \geq 0$ $9k^2 - 6k + 1 - 8k - 40 \geq 0$ $9k^2 - 14k - 39 \geq 0$ $k \geq 3$, $k \leq \frac{-13}{9}$	3	**6**

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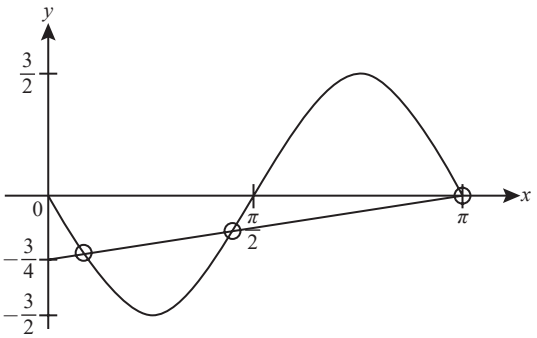
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
2	(*a*) $a = 0.888...$ ..... ① $10a = 8.888...$ ..... ② ② – ① : $9a = 8$ $a = \frac{8}{9}$ 0.888... ialah nombor nisbah kerana dapat ditulis dalam bentuk nisbah, $\frac{p}{q}$. 0.888... *is a rational nombor because can be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

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

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

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

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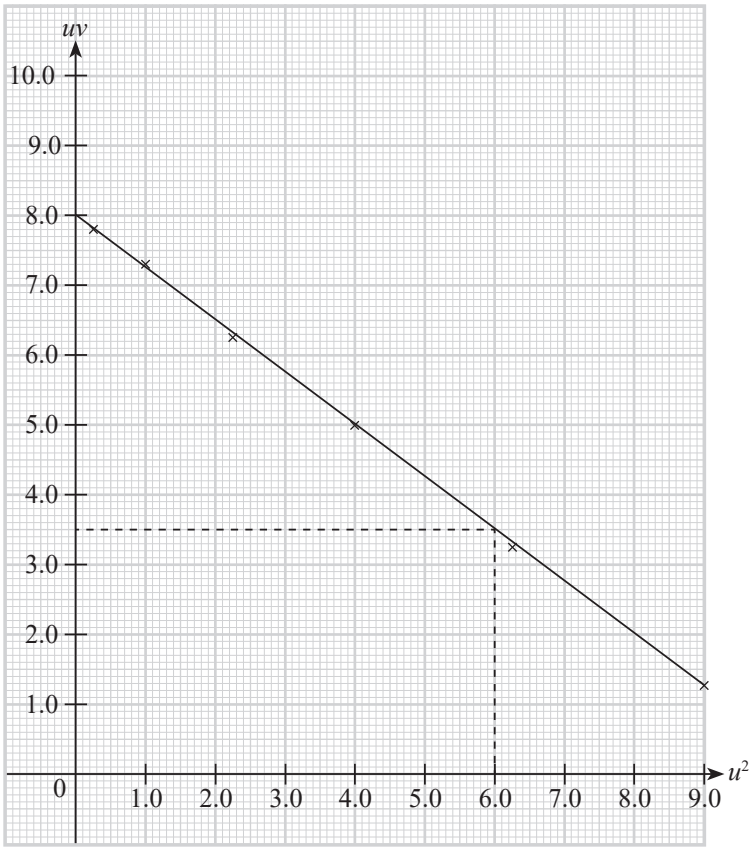
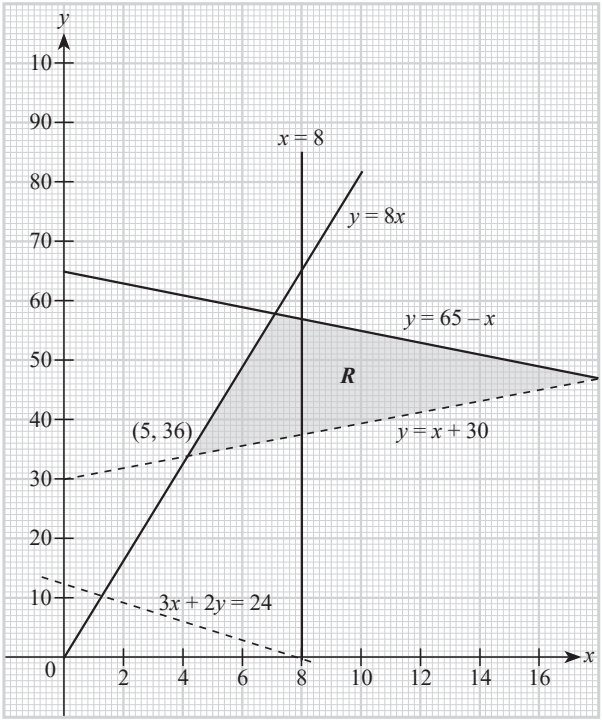
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	 (*b*) (i) $u = \sqrt{6} \rightarrow u^2 = 6$ $uv = 3.5$ $v = \dfrac{3.5}{\sqrt{6}}$ $= 1.43$ (ii) $m = \dfrac{8-2}{8-0} = 0.75$ $c = 8.0$ $Y = 0.75X + 8$ $uv = 0.75u^2 + 8$ $v = 0.75u + \dfrac{8}{u}$	5 5	 **10**
11	(*a*)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

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

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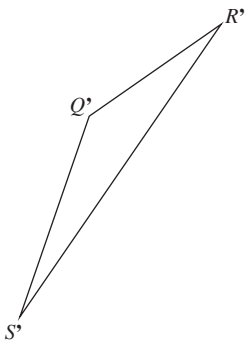
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*c*) (i) Apabila/*When* $x = 8$, $39 \le y \le 57$ atau/*or* $38 < y \le 57$ (ii) $120x + 80y = k$ Katakan/*Let* $k = 960$ $120x + 80y = 960$ $3x + 2y = 24$ Kos minimum/*Minimum cost* $= 120(5) + 80(36)$ $=$ RM3 480	4	**10**
13	(*a*) $\frac{x}{3.60} \times 100 = 125$ $x =$ RM4.50 $\frac{6.60}{y} \times 100 = 110$ $y =$ RM6.00 $z = \frac{4.60}{4.00} \times 100$ $= 115$	3	
	(*b*) $\bar{I}_{2020/2018} = \frac{(120 \times 5) + (125 \times 3) + (110 \times 2) + (115 \times 4)}{5 + 3 + 2 + 4}$ $= 118.21$ Peratus peningkatan bagi kos ialah 18.21%. *The increase in percentage for the cost is* 18.21%.	3	
	(c) $\left(I_{2021/2020}\right)_A = 108.33$, $\left(I_{2021/2020}\right)_B = 104$, $\left(I_{2021/2020}\right)_C = 118.18$, $\left(I_{2021/2020}\right)_D = 113.04$ $\bar{I}_{2021/2020} = \frac{(108.33 \times 5) + (104 \times 3) + (118.18 \times 2) + (113.04 \times 4)}{5 + 3 + 2 + 4}$ $= 110.16$ $\frac{\bar{Q}_{2021}}{40} \times 100 = 110.16$ $\bar{Q}_{2021} =$ RM 44.06	4	**10**
14	(*a*) (i) $8.3^2 = 5.1^2 + 11.9^2 - 2(5.1)(11.9)\ \text{kos}/\cos \angle SQR$ $\angle SQR = 35.57°$ (ii) $\frac{11.9}{\sin 65°} = \frac{PS}{\sin 79.43°}$ $PS = 12.907$ cm	4	
	(*b*) $s = \frac{5.1 + 8.3 + 11.9}{2} = 12.65$ Luas ΔQRS /*Area of* ΔQRS $= \sqrt{12.65(12.65 - 5.1)(12.65 - 8.3)(12.65 - 11.9)}$ $= 17.652\ \text{cm}^2$ Luas ΔPQS /*Area of* $\Delta PQS = \frac{12.907}{5.1} \times 17.652$ $= 44.67\ \text{cm}^2$	4	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*c*)  $\angle S'Q'R' = 180° - 35.57° = 144.43°$	2	**10**
15	(*a*) $\frac{d}{dt}(t^2 - 6t + 5) = 0$ $2t - 6 = 0$ $t = 3$ s $v = (3)^2 - 6(3) + 5$ $= -4$ m s^{-1}	3	
	(*b*) $t^2 - 6t + 5 < 0$ $(t - 1)(t - 5) < 0$ $1 < t < 5$	2	
	(*c*) $a < 0$ $2t - 6 < 0$ $t < 3$ s Jumlah jarak/*Total distance* $= \int_0^1 (t^2 - 6t + 5)\,dt + \left\lvert \int_1^3 (t^2 - 6t + 5)\,dt \right\rvert$ $= \left[\frac{t^3}{3} - 3t^2 + 5t\right]_0^1 + \left\lvert \left[\frac{t^3}{3} - 3t^2 + 5t\right]_1^3 \right\rvert$ $= 7\frac{2}{3}$ m	5	**10**

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KERTAS MODEL SPM SET 3

KERTAS 1

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

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

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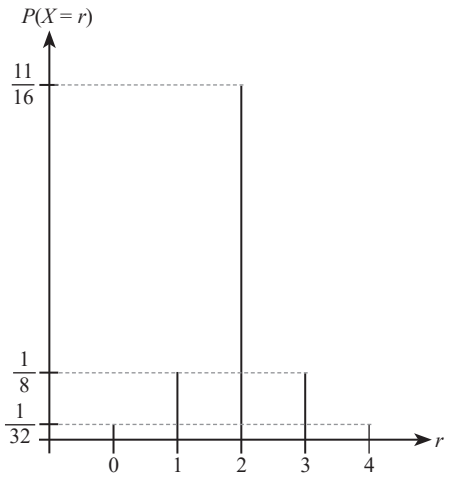
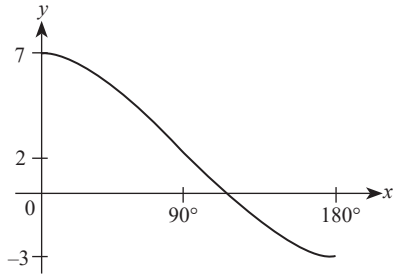
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
7	$\frac{1}{2}(AT)(10) = 60$ $AT = 12$ cm $\tan \angle AOT = \frac{12}{10}$ $\angle AOT = 50.19°$ $= 50.19 \times \frac{\pi}{180°}$ $= 0.876$ rad Luas sektor / *Area of sector AOB* $= \frac{1}{2}(10)^2(0.876)$ $= 43.80$ cm^2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

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

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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(ii) $\frac{dy}{dx} = -x^{-2} + x^{-\frac{1}{2}}$ $\frac{d^2y}{dx^2} = 2x^{-3} - \frac{1}{2}x^{-\frac{3}{2}}$ $= \frac{2}{x^3} - \frac{1}{2x^{\frac{3}{2}}}$	4	
	(*b*) $-\frac{1}{x^2} + \frac{1}{x^{\frac{1}{2}}} = 0$ $\frac{-1 + x^{\frac{3}{2}}}{x^2} = 0$ $x^{\frac{3}{2}} = 1$ $x = (1)^{\frac{2}{3}}$ $x = 1$ Gantikan $x = 1$ dalam $y = \frac{1}{x} + 2\sqrt{x}$ *Subsitute* $x = 1$ *into* $y = \frac{1}{x} + 2\sqrt{x}$ $y = \frac{1}{1} + 2 = 3$ Titik pusingan / *Turning Point* = (1, 3) Gantikan / *Subsitute* $x = 1$ dalam / *into* $\frac{d^2y}{dx^2}$ $\frac{d^2y}{dx^2} = \frac{2}{1} - \frac{1}{2} = \frac{3}{4}$ $\frac{d^2y}{dx^2} > 0$ (1, 3) ialah titik minimum/(1, 3) *is a minimum point.*	4	**8**
15	(*a*) $y = \frac{1}{2}[(x+4)^2 + (x-2)^2]$ $= \frac{1}{2}(x^2 + 8x + 16 + x^2 - 4x + 4)$ $= \frac{1}{2}(2x^2 + 4x + 20)$ $= x^2 + 2x + 10$ $= (x+1)^2 - 1 + 10$ $= (x+1)^2 + 9$ Titik minimum ialah (–1, 9)/*The minimum point is* (–1, 9)	5	
	(*b*) $3x^2 - 4x + 5 = 0$ $\alpha + \beta = \frac{4}{3}$ $\quad\quad$ $\alpha\beta = \frac{5}{3}$ $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$ $= \left(\frac{4}{3}\right)^2 - 2\left(\frac{5}{3}\right)$ $= \frac{16}{9} - \frac{10}{3}$ $= \frac{16 - 30}{9}$ $= -\frac{14}{9}$	3	**8**

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KERTAS 2

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

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

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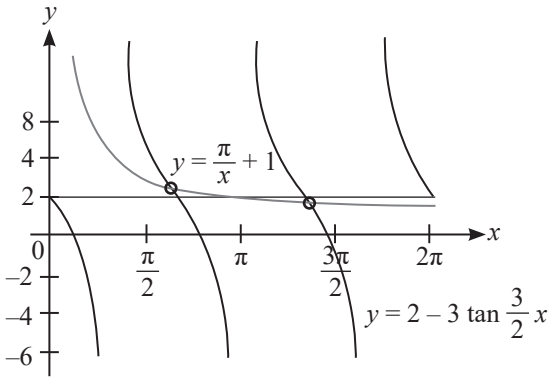
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) $\frac{1}{2}p = \frac{2}{3}q$ $p = \frac{4}{3}q$ ..... ① $\frac{1}{2}p = 1 - q$ ..... ② Gantikan ① dalam ② *Subsitute* ① *into* ② $\frac{1}{2}\left(\frac{4}{3}q\right) = 1 - q$ $\frac{5}{3}q = 1$ $q = \frac{3}{5}$ $p = \frac{4}{3}\left(\frac{3}{5}\right)$ $= \frac{4}{5}$	3	**8**
6	$f(x) = \frac{x}{x+1}$ $f^2(x) = \frac{\frac{x}{x+1}}{\frac{x}{x+1}+1}$ $= \frac{x}{2x+1}$ $f^3(x) = f[f^2(x)]$ $= f\left(\frac{x}{2x+1}\right)$ $= \frac{x}{3x+1}, x \neq -\frac{1}{3}$ $f^n(x) = \frac{x}{nx+1}, x \neq -\frac{1}{n}$	7	**7**
7	(*a*) & (*b*)  $\begin{array}{\|c\|c\|c\|c\|}\hline x & \frac{\pi}{2} & \pi & 2\pi \\ \hline y & 3 & 2 & \frac{3}{2} \\ \hline \end{array}$ 2 penyelesaian/*solutions*	4	

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

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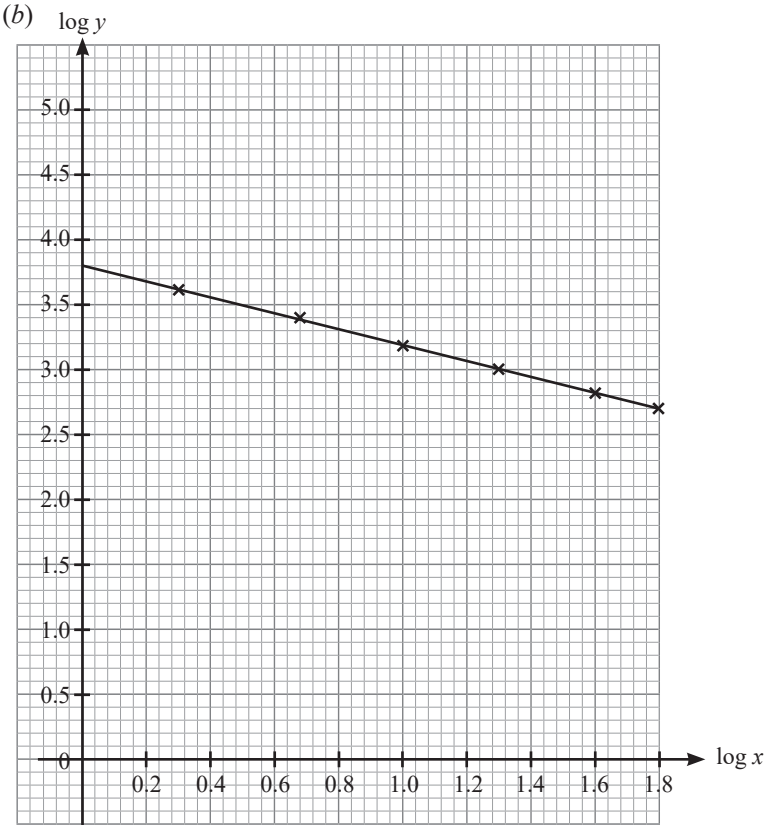
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
9	(*a*) $\begin{array}{\|c\|c\|c\|c\|c\|c\|c\|}\hline \log x & 0.301 & 0.699 & 1.000 & 1.301 & 1.602 & 1.778 \\ \hline \log y & 3.615 & 3.400 & 3.203 & 2.993 & 2.775 & 2.667 \\ \hline \end{array}$ (*b*)  (*c*) $y = k\,x^n$ $\log y = \log k + \log x^n$ $\log y = \log k + n \log x$ n = kecerunan / *gradient* $= \dfrac{2.993 - 2.667}{1.301 - 1.778}$ $= -0.683$ $\log k$ = pintasan-y/ *y-intercept* $= 3.8$ $k = 6\,310$	2 4 2	**8**
10	(*a*) Isi padu / *Volume A* $= \int_{-1}^{1} \pi y^2\,dx$ $= \int_{-1}^{1} \pi(x + 1)\,dx$ $= \pi\left[\dfrac{x^2}{2} + x\right]_{-1}^{1}$ $= \pi\left(\dfrac{3}{2}\right) - \pi\left(-\dfrac{1}{2}\right)$ $= 2\pi$		

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

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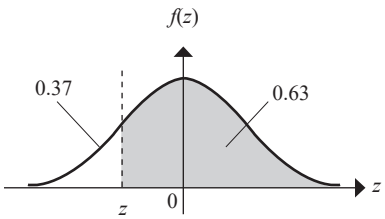
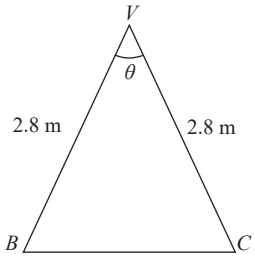
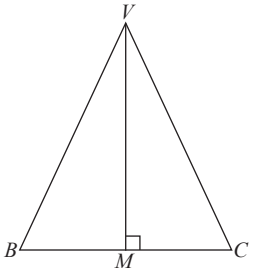
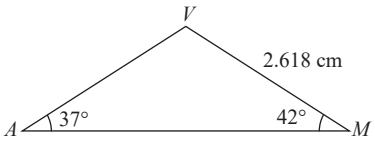
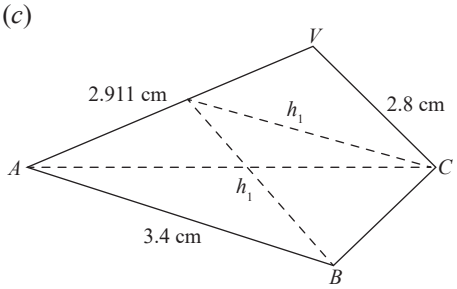
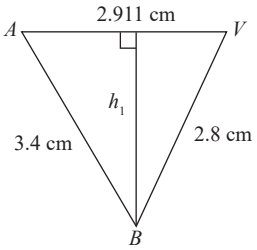
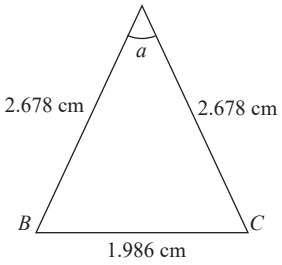
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(ii) $P(Z > z) = 0.63$  $P(Z > z) = 0.37$ $z = 0.332$ $= -0.332$ $X = 41.02$ Markah lulus / *Passing grade* $= 41$	4	**8**
12	(*a*)  $\frac{1}{2}(2.8)^2 \sin\theta = 2.6$ $\theta = 41.55°$ $BC = 2(2.8)\sin\left(\frac{41.55}{2}\right)$ $= 1.986$ m (*b*)   $\frac{VA}{\sin 42} = \frac{2.618}{\sin 37}$ $VA = 2.911$ m $\frac{1}{2}(VM)(1.986) = 2.6$ $VM = 2.618$ m	2 3	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*c*)   $s = \frac{3.4 + 2.911 + 2.8}{2}$ $= 4.5555$ m Luas *VAB* / *Area VAB* $= \sqrt{(4.5555)(1.1555)(1.6445)(1.7555)}$ $= 3.898$ m^2 $\frac{1}{2}(2.911)(h_1) = 3.898$ $h_1 = 2.678$ m $h_1 = h_2 = 2.678$ m  $1.986^2 = 2.678^2 + 2.678^2 - 2(2.678)^2$ kos/cos α kos/cos α $= 0.7250$ α $= 43.53°$	5	**10**
13	(*a*) (i) $y = 130$ (ii) $\frac{3.90}{x} \times 100 = 130$ $x =$ RM3.00 $z = \frac{4.80}{3.20} \times 100$ $= 150$ (*b*) $I = \frac{108(6) + 130(5) + 170(3) + 150(1)}{6 + 5 + 3 + 1}$ $= 130.5$ (*c*) (i) $160 = \frac{130.5 \times I}{100}$ $I = 122.6$ (ii) $112.6 = \frac{Q_1}{2.40} \times 100$ $Q_1 =$ RM2.94	3	

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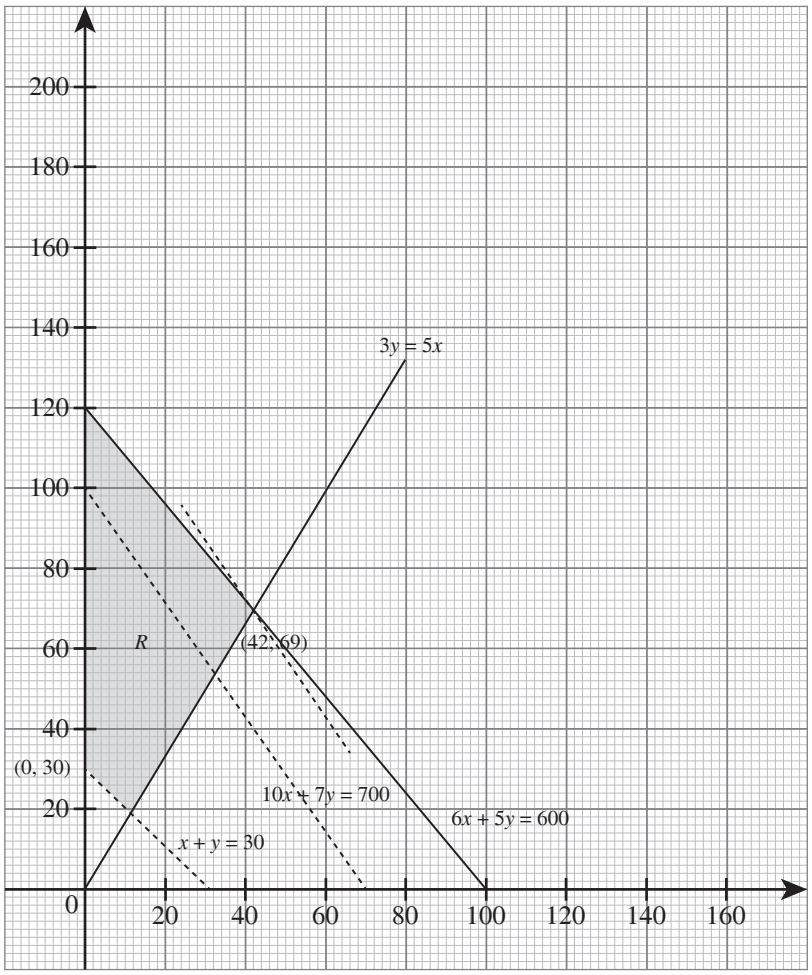
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	Bahagian maksimum bahan pencuci yang boleh dihasilkan *Maximum number of detergent that can be produced* $= \frac{\text{RM}195\,000}{\text{RM}2.94}$ = 66 327 botol/*bottles*	5	**10**
14	(*a*) $v = 3t^2 - 15t + 12$ $3t^2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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*)  	3	
	(*c*) Katakan/*Let k* = 700 Apabila/*when* (0, 30) Jualan / *Sales* = 10(0) + 7(30) = RM210 Apabila/*When* (42, 69) Jualan / *Sales* = 10(42) + 7(69) = RM903 Julat jualan, *J* / *Range of sales*, *J*: $210 < J \leq 903$	4	**10**

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