Yakin
Pustaka Yakin Pelajar Sdn. Bhd.

KERTAS SOALAN PEPERIKSAAN SEBENAR SPM 2021-2022

FORMAT TERKINI

MATEMATIK TAMBAHAN

Dwibahasa

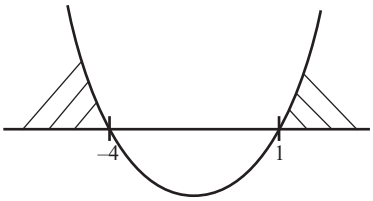
SIJIL PELAJARAN MALAYSIA 2021

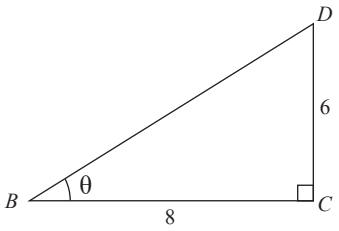
KERTAS 1

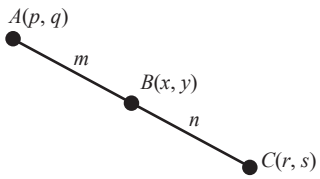
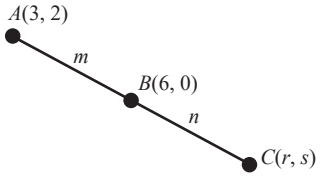
Bahagian A

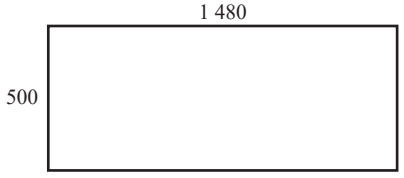
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
1	$\angle AOB$ major $= 2\pi - \frac{\pi}{3}$ $= \frac{5}{3}\pi$ Luas / *Area* $= \frac{1}{2}(2)^2\left(\frac{5}{3}\pi\right)$ $= \frac{10}{3}\pi$ cm^2	 1 1	 2
2	$m = \frac{7-1}{5-2} = 2$ $\frac{c-1}{0-2} = 2$ $c - 1 = -4$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

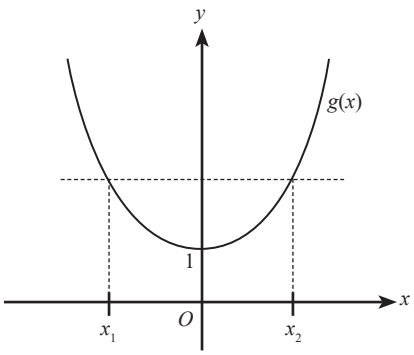
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
8	(*a*)  $\frac{q-y}{y-s}=\frac{m}{n}$ $nq-ny=my-ms$ $ms+nq=(m+n)y$ $y=\frac{ms+nq}{m+n}$ $\frac{x-p}{r-x}=\frac{m}{n}$ $nx-np=mr-mx$ $(m+n)x=mr+np$ $x=\frac{mr+np}{m+n}$ $(x,y)=\left(\frac{mr+np}{m+n},\frac{ms+nq}{m+n}\right)$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

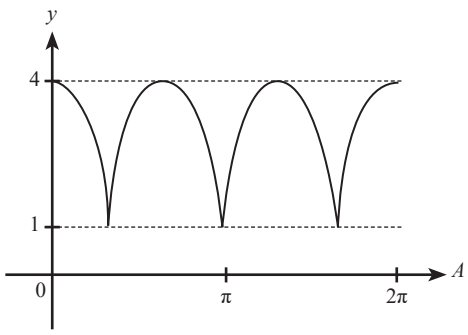
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) $\frac{(5+\sqrt{7})t}{2} = 9(\sqrt{7}-1)$ $(5+\sqrt{7})t = 18\sqrt{7}-18$ $t = \frac{18\sqrt{7}-18}{5+\sqrt{7}} \times \frac{5-\sqrt{7}}{5-\sqrt{7}}$ $= \frac{90\sqrt{7}-126-90+18\sqrt{7}}{25-7}$ $= \frac{108\sqrt{7}-216}{18}$ $= 6\sqrt{7}-12$	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

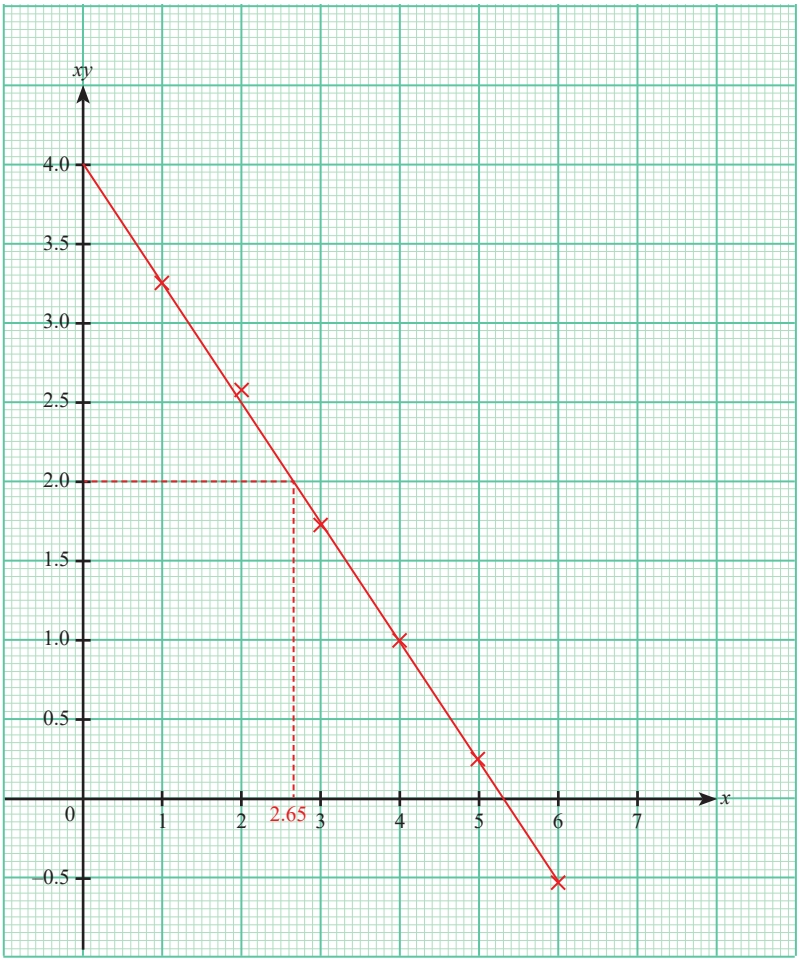
8	(*a*) (i) $A = (26 - 2x)(x)$ $= 26x - 2x^2$ (ii) $\frac{dA}{dx} = 0$ $26 - 4x = 0$ $x = 6.5$ cm $A_{\text{maksimum / } maximum} = 26(6.5) - 2(6.5)^2$ $= 84.5$ cm^2	1 1 1 1	

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	

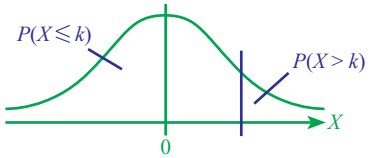
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) (i) $m_{PA} = \frac{y-2}{x-3}$, $m_{PB} = \frac{y-(-8)}{x-(-1)}$	1	
	$\left(\frac{y-2}{x-3}\right)\left(\frac{y-(-8)}{x-(-1)}\right) = -1$	1	
	$y^2 + 8y - 2y - 16 = -(x^2 + x - 3x - 3)$		
	$x^2 + y^2 - 2x + 6y - 19 = 0$	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

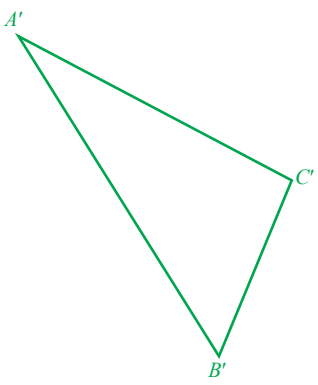
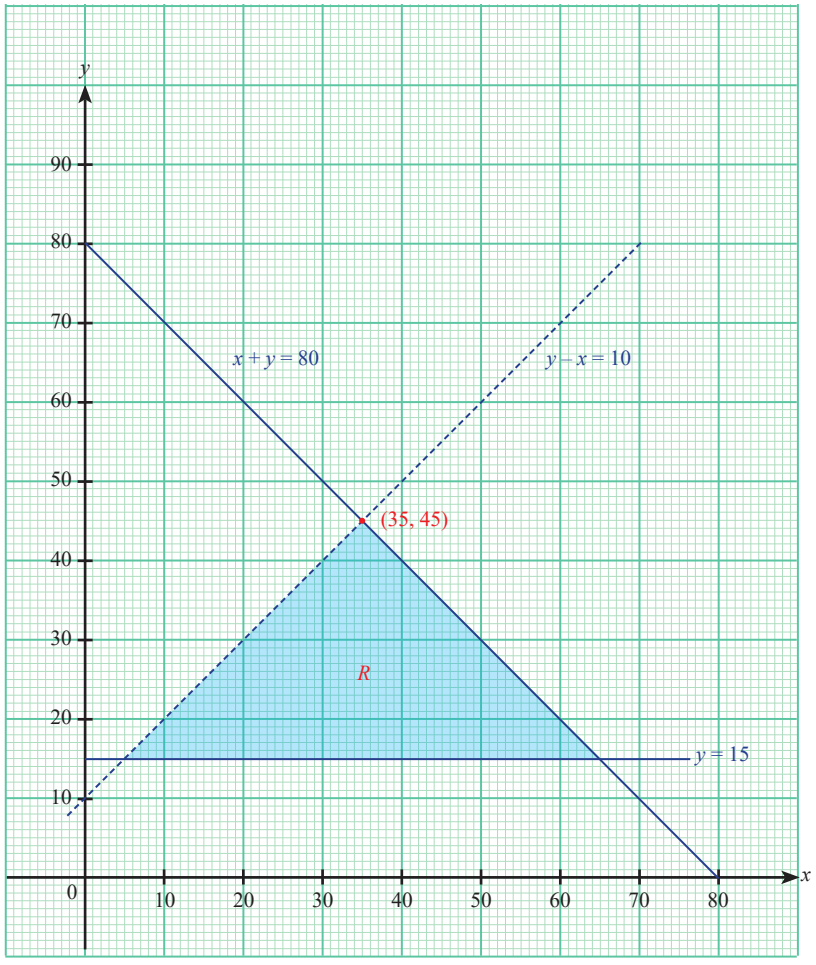
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	(*b*) (i) $y^2 = \frac{4}{x^2}$ $x^2 y^2 = 4$ $(xy)^2 = 4$ $xy = 2$ $x = 2.65$	1	
	(ii) $y + \sqrt{h} = \frac{k^2}{x}$ $xy + x\sqrt{h} = k^2$ $xy = (-\sqrt{h})\,x + k^2$	1	
	$m = \frac{4-1}{0-4}$ $= -\frac{3}{4}$ $m = -\sqrt{h}$	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**

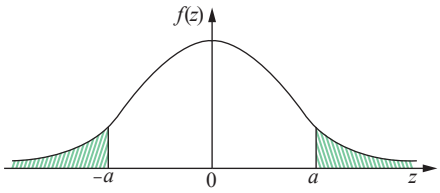
SIJIL PELAJARAN MALAYSIA 2022

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**

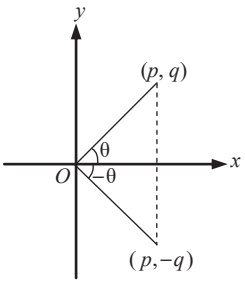
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
4	(*a*) $\frac{dV}{dt} = \frac{-5.5}{60}$ cm^3 s^{-1} $V = x^3$ $\frac{dV}{dx} = 3x^2$ Bila / *When* $x = 15$, $\frac{dV}{dx} = 3(15)^2$ $= 675$ $\frac{dx}{dt} = \frac{dx}{dV} \times \frac{dV}{dt}$ $= \frac{1}{dV} \times \frac{dV}{dt}$ $= \frac{1}{675} \times \frac{-5.5}{60}$ $= \frac{-11}{81\,000}$	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	

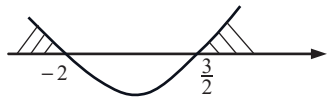
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Markah Total *Total Marks*
	Ganti / *Substitute*, $p = -8, x = \frac{1}{2}, y = -6$ $-6 = \frac{(-8)\left(\frac{1}{2}\right)}{q\left(\frac{1}{2}\right) - 1}$ $-3q + 6 = -4$ $3q = 10$ $q = \frac{10}{3}$	1 1	4
7	(*a*) $\frac{120\pi}{180} = \frac{2}{3}\pi$	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**

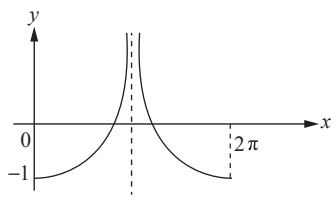
KERTAS 2

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

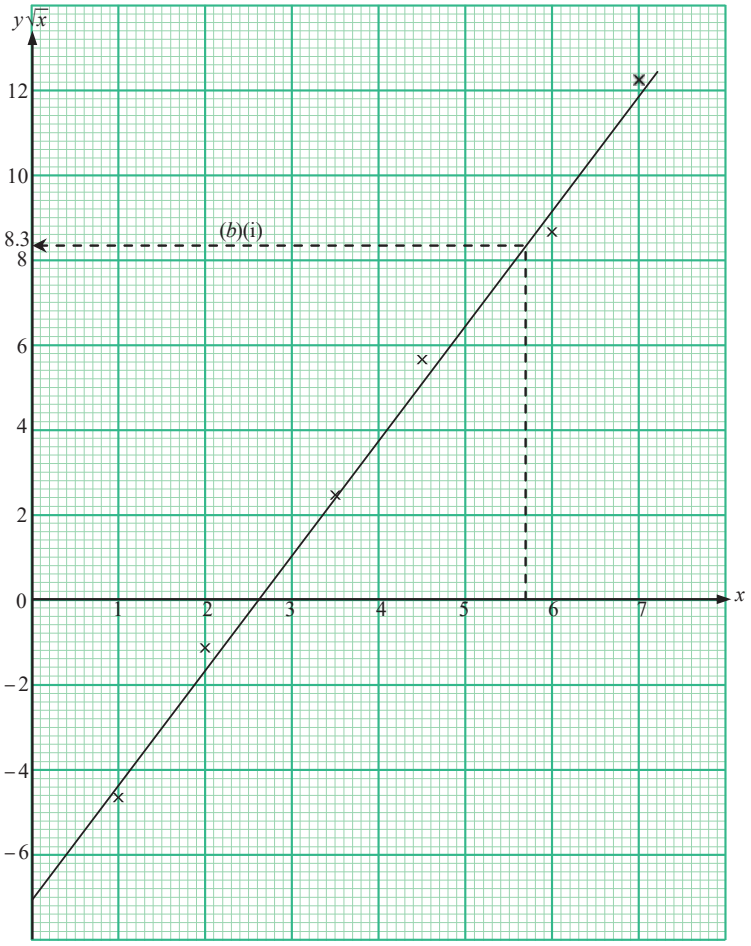
8	(*a*) (i) $\overrightarrow{OP} = \overrightarrow{OA} + \overrightarrow{AP}$ $= \underline{a} + \frac{1}{3}(-\underline{a} + \underline{b})$ $= \frac{2}{3}\underline{a} + \frac{1}{3}\underline{b}$ (ii) $\overrightarrow{BQ} = \overrightarrow{BO} + \overrightarrow{OQ}$ $= -\underline{b} + k\left(\frac{2}{3}\underline{a}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

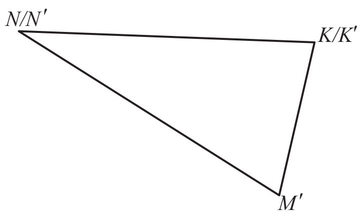
1

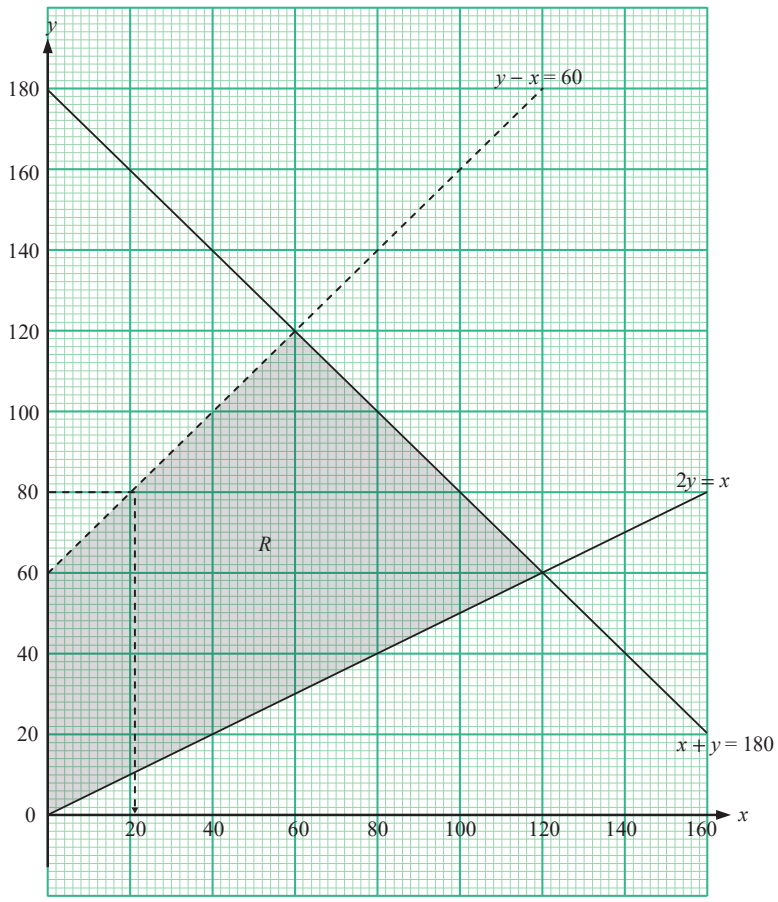


3

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	
	$m = \frac{2.41 - (-7)}{3.5 - 0}$ $= 2.689$ $\frac{1}{a} = -7$	2	
	$a = -\frac{1}{7}$ $\frac{b}{-\frac{1}{7}} = 2.689$ $b = -0.3841$	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**