Pustaka Yakin Pelajar Sdn. Bhd.

JAWAPAN DAN ULASAN

MATEMATIK TAMBAHAN

Dwibahasa

Bab 1 FUNGSI

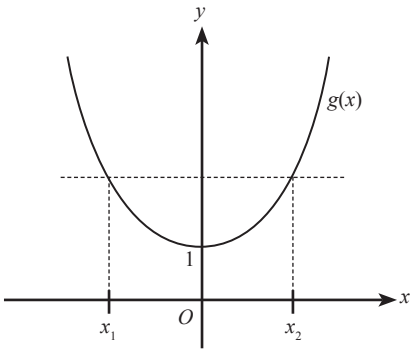
Kertas 1

Bahagian A

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah markah *Total marks*
1	(*a*) $x = 6$	1	
	(*b*) $\frac{3p}{6-2} = 9$ $3p = 36$ $p = 12$	1 1	3
2	(*a*) $f(7) = h$ $\lvert 7-3 \rvert + 1 = h$ $\lvert 4 \rvert + 1 = h$ $h = 5$ $f(x) = 5$ $\lvert x-3 \rvert + 1 = 5$ $\lvert x-3 \rvert = 4$ $x - 3 = 4$, $x - 3 = -4$ $x = 7$, $x = -1$ $\therefore$ Objek bagi h ialah -1. *Object of h is* -1.	1 1	
	(*b*) (i) $f(x) = 4x - 1$ Katakan / *Let* $4x - 1 = y$ $4x = y + 1$ $x = \frac{y+1}{4}$ $f^{-1}(x) = \frac{x+1}{4}$ $f^{-1}(p) = 2$ $\frac{p+1}{4} = 2$ $p + 1 = 8$ $p = 7$	1 1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah markah *Total marks*
	(ii) $fg(x) = 5f(2)$ $f(2x + 3) = 5[4(2) - 1]$ $4(2x + 3) - 1 = 5(8 - 1)$ $8x + 12 - 1 = 5(7)$ $8x + 11 = 35$ $8x = 24$ $x = 3$	1 1	**6**

Bahagian B

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah markah *Total marks*
3	(*a*) $\dfrac{3}{4x - 1} = \dfrac{1}{3}$ $x = \dfrac{5}{2}$	1 1	
	(*b*) $f(m + 1) = 3fg(p)$ $\dfrac{3}{4(m + 1) - 1} = 3\left(\dfrac{3}{4p^2 + 3}\right)$ $3(4m + 4 - 1) = 4p^2 + 3$ $12m + 9 = 4p^2 + 3$ $m = \dfrac{4p^2 - 6}{12}$ $m = \dfrac{2p^2 - 3}{6}$	 1 1	
	(*c*) (i) $\dfrac{3}{4g(x) - 1} = \dfrac{3}{4x^2 + 3}$ $4g(x) - 1 = 4x^2 + 3$ $g(x) = x^2 + 1$ (ii) Ujian garis mengufuk *Horizontal line test*  Bukan hubungan satu kepada satu *Not one to one relationship*	1 1 1 1	**8**

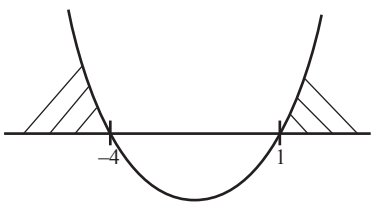
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah markah *Total marks*
4	(*a*) $2x - 5 \neq 0$ $2x \neq 5$ $x \neq \frac{5}{2}$ $\therefore h = \frac{5}{2}$	1	
	(*b*) $f(x) = x$ $2x - 5 = x$ $2x - x = 5$ $x = 5$	1 1	
	(*c*) (i) $gf(x) = \frac{4}{2x-5}$ $g(2x-5) = \frac{4}{2x-5}$ Katakan / *Let* $2x - 5 = m$ $2x = m + 5$ $x = \frac{m+5}{2}$ $g(m) = \frac{4}{2\left(\frac{m+5}{2}\right) - 5}$ $= \frac{4}{m+5-5}$ $= \frac{4}{m}$ $\therefore g(x) = \frac{4}{x}, x \neq 0$	1 1	
	(ii) $g^2(x) = g\left(\frac{4}{x}\right)$ $= \frac{4}{\frac{4}{x}}$ $= x$	1	
	$g^3(x) = gg^2(x)$ $= g(x)$ $g^3(x) = \frac{4}{x}$	1	
	$g^4(x) = g^2g^2(x)$ $= g^2(x)$ $g^4(x) = x$ $g^{\text{ganjil / odd}}(x) = \frac{4}{x}$ $g^{\text{genap / even}}(x) = x$ $4n - 3$ adalah ganjil bagi semua integer, n. $4n - 3$ *is odd for all integer*, n. $\therefore g^{4n-3}(x) = \frac{4}{x}, x \neq 0$	1	**8**

Bahagian A

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah markah *Total marks*
1	(*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
2	(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

Kertas 1

Bahagian A

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah markah *Total marks*
1	(*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*	Jumlah markah *Total marks*
2	(*a*) $y = -x + c$ ... ① $y = -2x^2 + 3x + p$ ... ② ① = ②: $-2x^2 + 3x + p = -x + c$ $-2x^2 + 3x + p + x - c = 0$ $-2x^2 + 4x + p - c = 0$ Tangen kepada lengkung / *Tangent to the curve*, $b^2 - 4ac = 0$ $(4)^2 - 4(-2)(p - c) = 0$ $16 + 8(p - c) = 0$ $16 + 8p - 8c = 0$ $8p = 8c - 16$ $p = c - 2$	 1 1 1	
	(*b*) $(x + 1)(-3x - 3) < x - 1$ $-3x^2 - 3x - 3x - 3 - x + 1 < 0$ $-3x^2 - 7x - 2 < 0$ $3x^2 + 7x + 2 > 0$ $(3x + 1)(x + 2) > 0$ Apabila $(3x + 1)(x + 2) = 0$, $x = -\frac{1}{3}$ atau -2. *When* $(3x + 1)(x + 2) = 0$, $x = -\frac{1}{3}$ *or* -2.		

	$x < -2$	$-2 < x < -\frac{1}{3}$	$x > -\frac{1}{3}$
$(3x + 1)$	–	–	+
$(x + 2)$	–	+	+
$(3x + 1)(x + 2)$	+	–	+

(Marks: 1)

Daripada jadual, $(3x + 1)(x + 2) > 0$ apabila $x < -2$ atau $x > -\frac{1}{3}$.

From the table, $(3x + 1)(x + 2) > 0$ *when* $x < -2$ *or* $x > -\frac{1}{3}$.

$\therefore\ x < -2$ atau / *or* $x > -\frac{1}{3}$ (Marks: 1)

	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah markah *Total marks*
	(*c*) $2x^2 + 6x + 4p^2 = 0$ Punca / *Roots* $= p, 2p$ HTP / *SOR*: $p + 2p = -\frac{6}{2}$ $3p = -3$ $p = -1$ $\therefore\ 2x^2 + 6x + 4(-1)^2 = 0$ $2x^2 + 6x + 4 = 0$ Punca baru / *New roots*: $p - 1 = -1 - 1 = -2$, $p + 1 = -1 + 1 = 0$ HTP / *SOR*: $-2 + 0 = -2$ HDP / *POR*: $(-2)(0) = 0$ $x^2 -$ (HTP / *SOR*)x + (HDP / *POR*) $= 0$ $x^2 - (-2)x + 0 = 0$ $x^2 + 4x = 0$	 1 1 1	8

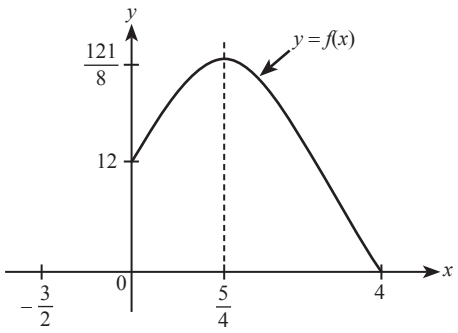
Bahagian B

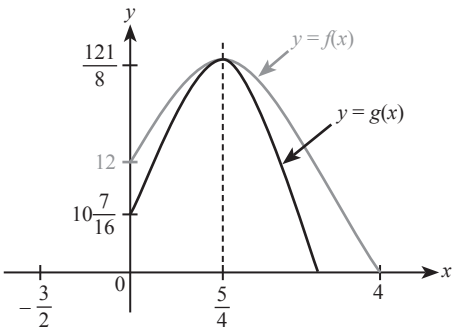
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah markah *Total marks*
3	(*a*) $-\frac{1}{4}+\left[-\frac{1}{4}-(-2)\right]=\frac{3}{2}$	1	
			
	$x<-2, x>\frac{3}{2}$	1	
	(*b*) $h^2-4(2)(-2k+5)>0$	1	
	$h^2+16k-40>0$		
	$k>\frac{40-h^2}{16}$	1	
	(*c*) $f(x)=2\left[x^2+\frac{h}{2}x\right]-2k+5$		
	$=2\left[x^2+\frac{h}{2}x+\left(\frac{\frac{h}{2}}{2}\right)^2-\left(\frac{\frac{h}{2}}{2}\right)^2\right]-2k+5$	1	
	$=2\left(x+\frac{h}{4}\right)^2-2\left(\frac{h}{4}\right)^2-2k+5$	1	
	$=2\left(x+\frac{h}{4}\right)^2-\frac{h^2}{8}-2k+5$		
	$-\frac{h}{4}=-\frac{1}{4}$	1	
	$h=1$		
	Nilai minimum / *Minimum value* $=-\frac{1^2}{8}-2k+5$		
	$=\frac{39}{8}-2k$	1	**8**

Kertas 2

Bahagian A

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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah markah *Total marks*
	(*b*) $2x^2 - 5x + p = x + 1$ $2x^2 - 6x + p - 1 = 0$ $(-6)^2 - 4(2)(p-1) = 0$ $36 - 8p + 8 = 0$ $p = \frac{44}{8}$ $p = \frac{11}{2}$	1 1 1	**6**
2	(*a*) $2x + 3 = 0$ $2x = -3$ $x = -\frac{3}{2}$ $f(x) = x(5 - 2x) + m$ $f(x) = 5x - 2x^2 + m$ $f(x) = -2x^2 + 5x + m$ Apabila / *When* $x = -\frac{3}{2}, f(x) = 0$ $-2\left(-\frac{3}{2}\right)^2 + 5\left(-\frac{3}{2}\right) + m = 0$ $-12 + m = 0$ $m = 12$	 1 1 1	
	(*b*) $f(x) = -2x^2 + 5x + 12$ $= -2\left(x^2 - \frac{5}{2}x - 6\right)$ $= -2\left[x^2 - \frac{5}{2}x + \left(\frac{-\frac{5}{2}}{2}\right)^2 - \left(\frac{-\frac{5}{2}}{2}\right)^2 - 6\right]$ $= -2\left[x^2 - \frac{5}{2}x + \left(-\frac{5}{4}\right)^2 - \left(-\frac{5}{4}\right)^2 - 6\right]$ $= -2\left[\left(x - \frac{5}{4}\right)^2 - \frac{25}{16} - 6\right]$ $= -2\left[\left(x - \frac{5}{4}\right)^2 - \frac{121}{16}\right]$ $= -2\left(x - \frac{5}{4}\right)^2 + \frac{121}{8}$ $\therefore a = -2, h = \frac{5}{4}, k = \frac{121}{8}$  	1 1 2	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah markah *Total marks*
	(*c*) $g(x) = (a-1)(x-h)^2 + k$ $= (-2-1)\left(x - \frac{5}{4}\right)^2 + \frac{121}{8}$ $= -3\left(x - \frac{5}{4}\right)^2 + \frac{121}{8}$  	1	**8**
3	(*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**

Kertas 2

Bahagian A

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *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*) $2p - q - r = 6$ $2p - r - 6 = q$ ... ① $p + 2q - 4r = 8$ ... ② $3p + q - r = 2$ ... ③ ① → ②; $p + 2(2p - r - 6) - 4r = 8$ $p + 4p - 2r - 12 - 4r = 8$ $5p - 6r - 20 = 0$ ... ④ ① → ③; $3p + (2p - r - 6) - r = 2$ $3p + 2p - r - 6 - r - 2 = 0$ $5p - 2r - 8 = 0$ ... ⑤ ⑤ − ④; $5p - 2r - 8 - (5p - 6r - 20) = 0$ $5p - 2r - 8 - 5p + 6r + 20 = 0$ $4r + 12 = 0$ $4r = -12$ $r = -3$	1 1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
	Dari / *From* ⑤, $5p - 2(-3) - 8 = 0$ $5p + 6 - 8 = 0$ $5p - 2 = 0$ $5p = 2$ $p = \frac{2}{5}$	1	
	Dari / *From* ①, $q = 2\left(\frac{2}{5}\right) - (-3) - 6$ $q = \frac{4}{5} + 3 - 6$ $q = -\frac{11}{5}$	1	
	$\therefore p = \frac{2}{5}, q = -\frac{11}{5}, r = -3$	1	**5**

Bab 4 INDEKS, SURD DAN LOGARITMA

Kertas 1

Bahagian A

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
1	(*a*) (i) $x^{2k+p} = x^0$ $2k + p = 0$ $p = -2k$ (ii) $a^p = (a^{1/k})^6$ Bandingkan kuasa / *Comparing power* $p = \frac{1}{k}(6)$ $p = \frac{6}{k}$	1 1	
	(*b*) $3^{y-2x-2} = 3^4$ Bandingkan kuasa / *Comparing power* $y - 2x - 2 = 4$ $y = 2x + 6$	1 1	**4**
2	(*a*) $2^x = 8y = \sqrt{2^{3z}}$ $2^x = (2^3)^y = (2^{3z})^{\frac{1}{2}}$ $2^x = 2^{3y} = 2^{\frac{3z}{2}}$ $x = 3y = \frac{3z}{2}$ $x = 3y$ $\frac{x}{y} = \frac{3}{1}$ $x : y = 3 : 1$ $3y = \frac{3z}{2}$ $\frac{y}{z} = \frac{\left(\frac{3}{2}\right)}{3}$	1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
	$\frac{y}{z} = \frac{1}{2}$ $y : z = 1 : 2$ $x : y : z$ $3 : 1$ $1 : 2$ $\therefore x : y : z = 3 : 1 : 2$	1	
	(*b*) $9^{2pq+1} + 3^{4pq-3} = 732$ $3^{2(2pq+1)} + 3^{4pq-3} = 732$ $3^{4pq+2} + 3^{4pq-3} = 732$ $(3^{4pq})(3^2) + (3^{4pq})(3^{-3}) = 732$ $3^{4pq}(3^2 + 3^{-3}) = 732$ $3^{4pq}\left(9 + \frac{1}{27}\right) = 732$ $3^{4pq}\left(\frac{244}{27}\right) = 732$ $3^{4pq} = 732 \div \frac{244}{27}$ $3^{4pq} = 81$ $3^{4pq} = 3^4$ $4pq = 4$ $pq = 1$ $p = \frac{1}{q}$	1 1 1	
	(*c*) $\frac{1}{\log_a ab} + \frac{1}{\log_b ab} = \log_{ab} a + \log_{ab} b$ $= \log_{ab}(a \times b)$ $= \log_{ab} ab$ $= 1$	1 1	**7**
3	$BD = \sqrt{(2+x)^2 - (2-x)^2}$ $= \sqrt{8x}$ $\sqrt{x} + \sqrt{8x} = \sqrt{1+\sqrt{2}}$ Kuasa dua kedua-dua bahagian / *Squaring both sides*, $\left(\sqrt{8x} + \sqrt{x}\right)^2 = \left(\sqrt{1+\sqrt{2}}\right)^2$ $9x + 2x\sqrt{8} = 1 + \sqrt{2}$ $x\left(9 + 2\sqrt{8}\right) = 1 + \sqrt{2}$ $x = \frac{1+\sqrt{2}}{9+2\sqrt{8}} \times \frac{9-2\sqrt{8}}{9-2\sqrt{8}}$ $= \frac{9 + 5\sqrt{2} - 8}{(9)^2 - \left(2\sqrt{8}\right)^2}$ $= \frac{1+5\sqrt{2}}{(9)^2 - \left(2\sqrt{8}\right)^2}$ $= \frac{1+5\sqrt{2}}{49}$	1 1 1 1 1	**5**

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
4	(*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

Bahagian B

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
5	(*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	
	$4(2^{2x})^2 + 2^x - 18 = 0$ $[4(2^x) + 9][2^x - 2] = 0$	1	
	$4(2^x) + 9 = 0$ $2^x = -\frac{9}{4}$		
	$2^x > 0$ $2^x = -\frac{9}{4}$ (tidak mungkin / *not possible*)		
	$2^x - 2 = 0$ $2^x = 2$ $x = 1$	1	
	(*b*) $\frac{\left(5+\sqrt{7}\right)t}{2} = 9\left(\sqrt{7}-1\right)$	1	
	$\left(5+\sqrt{7}\right)t = 18\sqrt{7} - 18$		
	$t = \frac{18\sqrt{7}-18}{5+\sqrt{7}} \times \frac{5-\sqrt{7}}{5-\sqrt{7}}$	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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
6	(*a*) (i) $6 \ln y = \sqrt{5} \ln x$ $6 \log_e y = \sqrt{5} \log_e x$ $\log_e y^6 = \log_e x^{\sqrt{5}}$ $y^6 = x^{\sqrt{5}}$ $y = \sqrt[6]{x^{\sqrt{5}}}$	 1 1	
	(ii) $\ln (x + y^2) - 3 = 0$ $\ln (x + y^2) = 3$ $\log_e (x + y^2) = 3$ $x + y^2 = e^3$ $y^2 = e^3 - x$ $y = \sqrt{e^3 - x}$	 1 1	
	(*b*) $\frac{x + 2\sqrt{2}}{2} : x\sqrt{2} - 1 = 6 : 1$ $\frac{\frac{1}{2}x + \sqrt{2}}{x\sqrt{2} - 1} = \frac{6}{1}$ $\frac{1}{2}x + \sqrt{2} = 6(x\sqrt{2} - 1)$ $\frac{1}{2}x + \sqrt{2} = 6x\sqrt{2} - 6$ $\frac{1}{2}x - 6x\sqrt{2} = -6 - \sqrt{2}$ $x\left(\frac{1}{2} - 6\sqrt{2}\right) = -6 - \sqrt{2}$ $x = \frac{(-6 - \sqrt{2})}{\left(\frac{1}{2} - 6\sqrt{2}\right)} \times \frac{\left(\frac{1}{2} + 6\sqrt{2}\right)}{\left(\frac{1}{2} + 6\sqrt{2}\right)}$ $x = \frac{-3 - 36\sqrt{2} - \frac{1}{2}\sqrt{2} - 12}{\frac{1}{4} - 72}$ $x = \frac{-15 - \frac{73}{2}\sqrt{2}}{-\frac{287}{4}}$ $x = \frac{-\left(\frac{30 + 73\sqrt{2}}{2}\right)}{-\frac{287}{4}}$ $x = \frac{30 + 73\sqrt{2}}{2} \times \frac{4}{287}$ $x = \frac{60 + 146\sqrt{2}}{287}$ $x = \frac{60}{287} + \frac{146}{287}\sqrt{2}$	 1 1 1 1	**8**

Kertas 2

Bahagian A

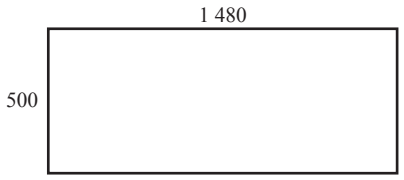
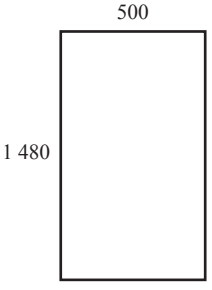
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
1	(*a*) $\sqrt{0.25}$ bukan suatu surd kerana ia merupakan nombor nisbah. $\sqrt{0.25}$ *is not a surd because it is a rational number.*	1	
	(*b*) (i) $\log_a b = x$ $b = a^x$ $\log_c b = \log_c a^x$ $\log_c b = x \log_c a$ $x = \dfrac{\log_c b}{\log_c a}$ $\log_a b = \dfrac{\log_c b}{\log_c a}$	1 1 1	
	(ii) $\log_3 h + \log_9 k = \log_3 h + \dfrac{\log_3 k}{\log_3 9}$ $= \log_3 h + \dfrac{\log_3 k}{\log_3 3^2}$ $= \log_3 h + \dfrac{\log_3 k}{2}$ $= \log_3 h + \dfrac{1}{2}\log_3 k$ $= \log_3 h + \log_3 k^{\frac{1}{2}}$ $= \log_3 hk^{\frac{1}{2}}$	1 1 1	7

Bab 5 JANJANG

Kertas 1

Bahagian A

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
1	(*a*) $(x, x + 20, x + 40)$ mm	1	
	(*b*) $a = x$ $T_{72} = x + (72 - 1)(20)$ $= x + 1\,420$ $S_{72} = 55\,440$ $\dfrac{72}{2}(x + x + 1\,420) = 55\,440$ $2x + 1\,420 = \dfrac{55\,440}{36}$ $x = 60$ 18 kepingan terakhir / *Last* 18 *terms*: $T_{55}, T_{56}, \ldots, T_{72}$ $S_{18} = \dfrac{18}{2}[2(60 + 30(20)) + (18 - 1)(20)]$ $= 14\,940$ mm	1 1 1 1 1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
	(*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	
	$V_1 = \pi r^2 h$ $= \pi \left(\frac{740}{\pi}\right)^2 (500)$ $= \frac{273\ 800\ 000}{\pi}\ \text{mm}^3$ $= \frac{2.738 \times 10^8}{\pi}\ \text{mm}^3$		
	Cara 2 / *Method* 2  $2\pi r = 500$ $r = \frac{500}{2\pi}$ $= \frac{250}{\pi}$ $V_2 = \pi r^2 h$ $= \pi \left(\frac{250}{\pi}\right)^2 (1\ 480)$ $= \frac{92\ 500\ 000}{\pi}\ \text{mm}^3$ $= \frac{9.25 \times 10^7}{\pi}\ \text{mm}^3$ $V_1 = \pi \left(\frac{740}{\pi}\right)^2 (500)$ dan / *and* $V_2 = \pi \left(\frac{250}{\pi}\right)^2 (1\ 480)$	1	
	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	**8**

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
2	(*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	
	(*b*) (i) $\frac{1}{2} \times 12 \times x = 72$ $x = 12$		
	$T_{31} = a + (31 - 1)d$ $= 12$ Diberi / *Given*, $a = 30d$	1	
	$30d + (31 - 1)d = 12$	1	
	$60d = 12$ $d = \frac{1}{5}$	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**
3	(*a*) Janjang aritmetik / *Arithmetic progression* $a, a + d, (a + d) + d, \ldots$	1	
	$T_4 = 3T_1$ $a + (4 - 1)(d) = 3a$ $a + 3d = 3a$ $3d = 2a$ ... ①		
	$S_4 = 72°$	1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
	$\frac{4}{2}[2a + (4-1)(d)] = 72$ $2(2a + 3d) = 72$ $2(2a + 2a) = 72$ $8a = 72$ $a = 9$ $\therefore$ Bahagian terkecil / *Smallest piece* $= T_1 = a = 9°$	1 1	
	(*b*) Dari / *From* ①, $3d = 2(9)$ $3d = 18$ $d = 6$ $S_n = 360°$ $\frac{n}{2}[2(9) + (n-1)(6)] = 360°$ $\frac{n}{2}(18 + 6n - 6) = 360°$ $n(6n + 12) = 720°$ $6n^2 + 12n - 720° = 0$ $n^2 + 2n - 120° = 0$ $(n - 10)(n + 12) = 0$ $n - 10 = 0$, $n + 12 = 0$ $n = 10$, $n = -12$ (abaikan / *ignore*) $\therefore n = 10$	 1 1 1	**7**
4	(*a*) $y - x = 45 - 50$ $y - x = -5$	 1	
	(*b*) $\frac{y}{x} = \frac{45}{50}$ $\frac{y}{x} = \frac{9}{10}$	 1	**2**
5	(*a*) $S_n < 650$ $217\left[\frac{1-\left(\frac{2}{3}\right)^n}{1-\frac{2}{3}}\right] < 650$ $1-\left(\frac{2}{3}\right)^n < \frac{650}{651}$ $1-\frac{650}{651} < \left(\frac{2}{3}\right)^n$ $\frac{1}{651} < \left(\frac{2}{3}\right)^n$ $\left(\frac{2}{3}\right)^n > \frac{1}{651}$ $n < \frac{\lg\left(\frac{1}{651}\right)}{\lg\left(\frac{2}{3}\right)}$ $n < 15.97$ $n = 15$	 1 1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
	(*b*) $S_\infty - T_5 = \dfrac{217}{1-\frac{2}{3}} - 217\left(\dfrac{2}{3}\right)^4$ $= 651 - \dfrac{3\,472}{81}$ $= 608\,\dfrac{11}{81}$	2 1	**5**

Kertas 2

Bahagian A

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

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
2	$S_{\infty A} = S_{\infty B}$ $\frac{8}{1-r_A} = \frac{4}{1-r_B}$ $8 - 8r_B = 4 - 4r_A$ $4r_A - 8r_B = 4 - 8$ $4r_A - 8r_B = -4$ $r_A - 2r_B = -1$ $r_A = 2r_B - 1 \ldots$ ①	1	
	$T_{3A} + T_{3B} = \frac{9}{4}$ $8(r_A)^{3-1} + 4(r_B)^{3-1} = \frac{9}{4}$ $8r_A^2 + 4r_B^2 = \frac{9}{4}$ $8(2r_B - 1)^2 + 4r_B^2 = \frac{9}{4}$ $8(4r_B^2 - 4r_B + 1) + 4r_B^2 - \frac{9}{4} = 0$ $32r_B^2 - 32r_B + 8 + 4r_B^2 - \frac{9}{4} = 0$ $36r_B^2 - 32r_B + \frac{23}{4} = 0$ $36r_B^2 - 32r_B + \frac{23}{4} = 0$ $144r_B^2 - 128r_B + 23 = 0$ $(36r_B - 23)(4r_B - 1) = 0$ $36r_B - 23 = 0$, $4r_B - 1 = 0$ $r_B = \frac{23}{36}$, $r_B = \frac{1}{4}$	1 1	
	$T_{10A} < 0$ $8(r_A)^{10-1} < 0$ $8(r_A)^9 < 0$ $r_A < 0 \ldots$ ② Dari / *From* ① & ②, $r_A = 2\left(\frac{23}{36}\right) - 1$, $r_A = 2\left(\frac{1}{4}\right) - 1$ $r_A = \frac{5}{18} < 0$ (abaikan / *ignore*) , $r_A = -\frac{1}{2} < 0$	1 1	
	$S_{4A} = \frac{8\left[1 - \left(-\frac{1}{2}\right)^4\right]}{1 - \left(-\frac{1}{2}\right)}$ $= 5 < S_{4B}$	1	
	$S_{4B} = \frac{4\left[1 - \left(\frac{1}{4}\right)^4\right]}{1 - \left(\frac{1}{4}\right)} = 5.3125$	1	
	∴ Pernyataan tersebut adalah palsu. / *The statement is false*.	1	**8**

Kertas 1

Bahagian A

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
1	(*a*) L_1 lebih sesuai kerana garis lurus tersebut melalui sebanyak mungkin titik dan terdapat jumlah titik yang sama di kedua-dua belah garis lurus. *L_1 is suitable because it passes through as many points as possible and there is equal number of points on both sides of the straight line.*	1	
	(*b*) $Y = mX + C$ $\frac{1}{y} = \frac{(7-4)}{(6-2)}(x^2) + C$ $\frac{1}{y} = \frac{3}{4}x^2 + C$ Pada / *At* (10, 9), $9 = \frac{3}{4}(10) + C$ $9 = \frac{15}{2} + C$ $\frac{3}{2} = C$ $\frac{1}{y} = \frac{3}{4}x^2 + \frac{3}{2}$ $\frac{1}{y} = \frac{3x^2+6}{4}$ $\frac{y}{1} = \frac{4}{3x^2+6}$ $y = \frac{4}{3x^2+6}$	1 1 1	4
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
3	$y = \frac{px}{qx-1}$ $\frac{1}{y} = \frac{qx-1}{px}$ $\frac{1}{y} = \frac{q}{p} - \frac{1}{px}$		

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

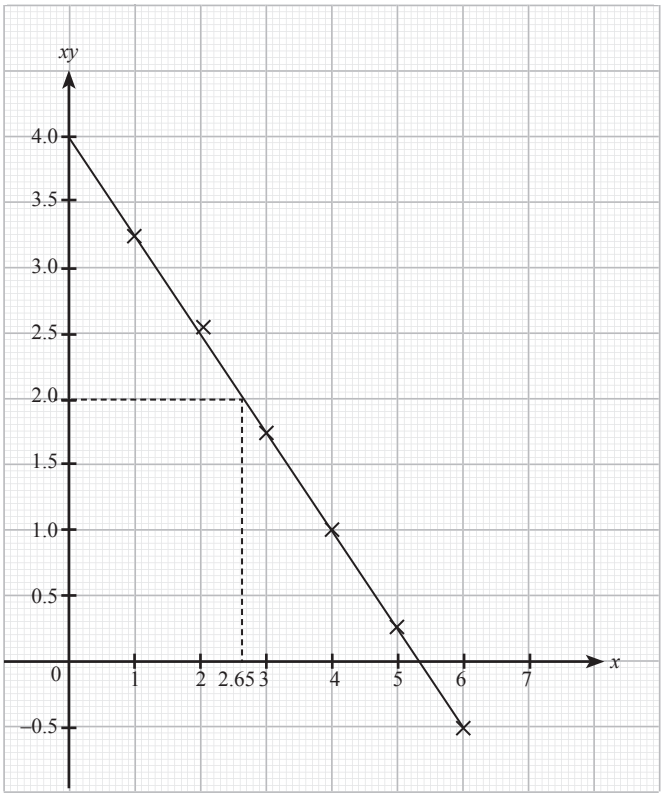
Kertas 2

Bahagian B

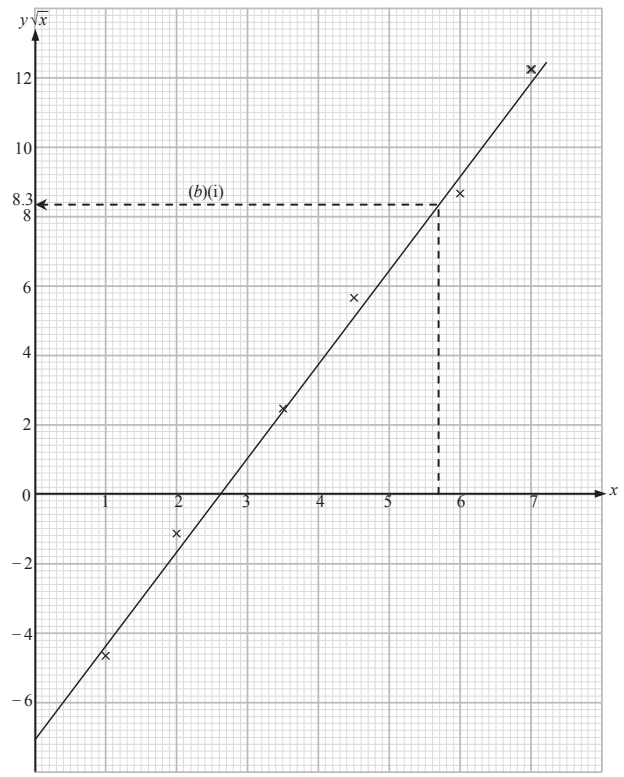
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
1	(*a*)		

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

1



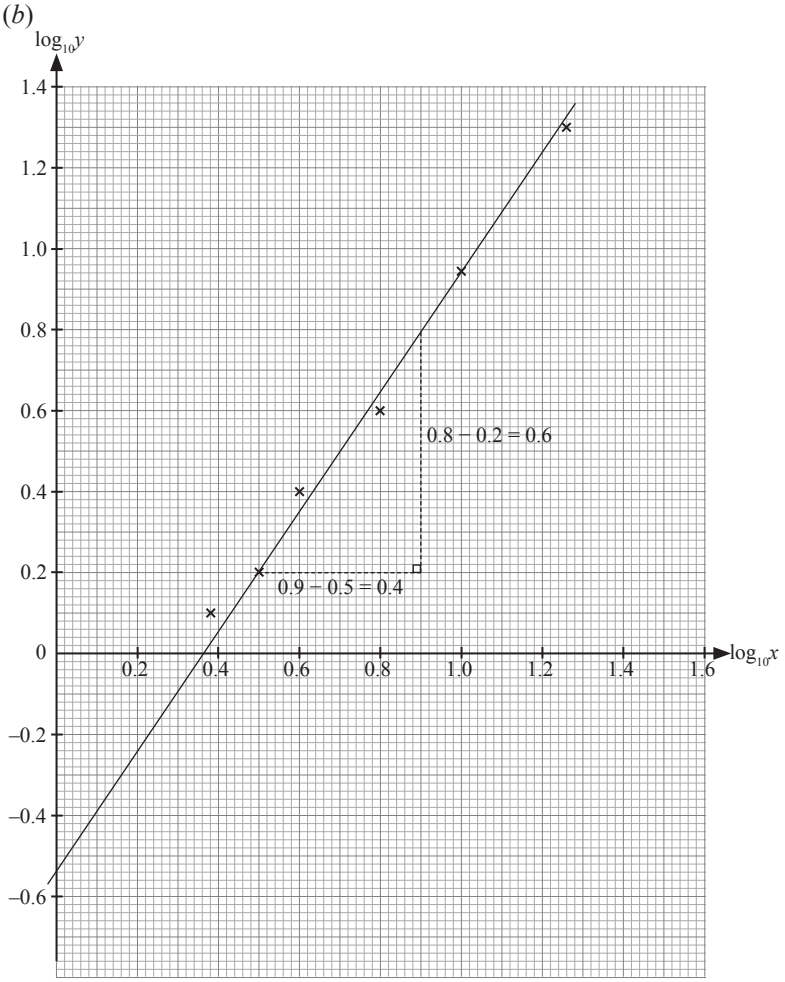
3

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah markah *Total marks*
	(*b*) (i) $y^2 = \frac{4}{x^2}$ $x^2 y^2 = 4$ $(xy)^2 = 4$ $xy = 2$ $x = 2.65$	1	
	(ii) $y + \sqrt{h} = \frac{k^2}{x}$ $xy + x\sqrt{h} = k^2$ $xy = (-\sqrt{h})\,x + k^2$	1	
	$m = \frac{4-1}{0-4}$ $= -\frac{3}{4}$	1	
	$m = -\sqrt{h}$ $-\sqrt{h} = -\frac{3}{4}$ $\sqrt{h} = \frac{3}{4}$ $h = \frac{9}{16}$	1	
	$c = k^2$ $k^2 = 4$ $k = 2$	1 1	**10**
2	<table><tr><td>x</td><td>1.0</td><td>2.0</td><td>3.5</td><td>4.5</td><td>6.0</td><td>7.0</td></tr><tr><td>$y\sqrt{x}$</td><td>−4.70</td><td>−1.12</td><td>2.41</td><td>5.60</td><td>8.60</td><td>12.20</td></tr></table>  	1 3	

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

$\log_{10}x$	0.3802	0.4997	0.5999	0.8000	1	1.2601
$\log_{10}y$	0.1004	0.2014	0.4014	0.5999	0.9499	1.3002

(*b*)



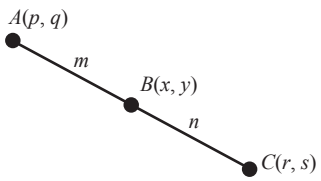
3

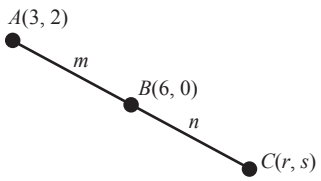
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
	(c) $x^a = by$ $\log_{10} x^a = \log_{10} by$ $a \log_{10} x = \log_{10} b + \log_{10} y$ $\log_{10} y = a \log_{10} x - \log_{10} b$ $Y = m \quad X + C$ $m = a = \frac{0.8 - 0.2}{0.9 - 0.5}$ $a = \frac{3}{2}$ $-\log_{10} b = -0.54$ $\log_{10} b = 0.54$ $b = 10^{0.54}$ $b = 3.4674$	1 1 1 1 1	**10**

Bab 7 GEOMETRI KOORDINAT

Kertas 1

Bahagian A

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah markah *Total marks*
1	(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 1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
	(*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**
2	p ialah nilai persilangan bagi paksi-y. / *p is the value of y-intercept.* $\therefore p = 2$ $\frac{x}{6} + \frac{y}{2} = 1$ $\frac{y}{2} = -\frac{x}{6} + 1$ $y = -\frac{1}{3}x + 2$ $\therefore m_1 = -\frac{1}{3}$ $y = qx$ $\therefore m_2 = q$ $\frac{x}{6} + \frac{y}{2} = 1$ adalah berserenjang dengan / *is perpendicular to* $y = qx$ $m_1 m_2 = -1$ $\left(-\frac{1}{3}\right) \times (q) = -1$ $q = 3$	1 1 1	**3**

Bahagian B

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
3	(*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

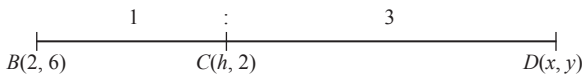
Bahagian A

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
1	(*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	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
	(*b*) $(-2, 1) = \left[\frac{2(-8) + 3(x)}{2+3}, \frac{2(-2) + 3(y)}{2+3}\right]$	1	
	$\frac{-16 + 3x}{5} = -2$ $x = 2$		
	$\frac{-4 + 3y}{5} = 1$ $y = 3$		
	$\therefore T(2, 3)$	1	**7**

Bahagian B

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
2	(*a*) (i) $(x, y) = \left(\frac{3+7}{2}, \frac{2+(-6)}{2}\right)$ $= (5, -2)$		
	$(5, -2) = \left(\frac{2x + 3(-1)}{2+3}, \frac{2y + 3(-8)}{2+3}\right)$	1	
	$5 = \frac{2x - 3}{5}$ $\quad -2 = \frac{2y - 24}{5}$ $25 = 2x - 3$ $\quad -10 = 2y - 24$ $2x = 28$ $\quad 2y = 14$ $x = 14$ $\quad y = 7$	1	
	$D(14, 7)$	1	
	(ii) Luas / *Area* ΔCDE $= \frac{1}{2}\begin{vmatrix} 5 & 14 & 7 & 5 \\ -2 & 7 & -6 & -2 \end{vmatrix}$		
	$= \frac{1}{2}\lvert[5 \times 7 + 14 \times (-6) + 7 \times (-2)] - [-2 \times 14 + 7 \times 7 + (-6) \times 5]\rvert$	1	
	$= \frac{1}{2}\lvert -54 \rvert$	1	
	$= 27 \text{ unit}^2$		
	(*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**

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
3	(*a*) (i)  $C(h, 2) = \left(\frac{3(2)+(1)(x)}{1+3}, \frac{(3)(6)+(1)(y)}{1+3}\right)$ $= \left(\frac{6+x}{4}, \frac{18+y}{4}\right)$ $\frac{6+x}{4} = h$, $\frac{18+y}{4} = 2$ $6+x = 4h$, $18+y = 8$ $x = 4h-6$, $y = 8-18$ $y = -10$ $\therefore D(4h-6, -10)$ (ii) Luas ΔACD / *Area of* $\Delta ACD = 27$ unit^2 $\frac{1}{2}\begin{vmatrix} -1 & h & 4h-6 & -1 \\ 0 & 2 & -10 & 0 \end{vmatrix} = 27$ $\begin{vmatrix} [(-1)(2)+(h)(-10)+(0)(4h-6)] \\ -[(0)(h)+(2)(4h-6)+(-10)(-1)] \end{vmatrix} = 54$ $\lvert(-2-10h)-(8h-12+10)\rvert = 54$ $\lvert-2-10h-8h+12-10\rvert = 54$ $\lvert-18h\rvert = 54$ $-18h = 54$, $-(-18h) = 54$ $h = -3$ (abaikan / *ignore*) $h = 3$ $\therefore h = 3$	1 1 1 1	
	(*b*) (i) $D(4h-6, -10)$ apabila / *when* $h = 3$ $\therefore D(6, -10)$ $BP = PD$ $\sqrt{(2-x)^2+(6-y)^2} = \sqrt{(6-x)^2+(-10-y)^2}$ $\sqrt{x^2-4x+4+y^2-12y+36} = \sqrt{x^2-12x+36+y^2+20y+100}$ $x^2+y^2-4x-12y+40 = x^2+y^2-12x+20y+136$ $-4x+12x-12y-20y+40-136 = 0$ $8x-32y-96 = 0$ (ii) Pintasan paksi-y / *Intersection of* y*-axis*, $x = 0$ $8x-32y-96 = 0$ $8(0)-32y-96 = 0$ $-32y = 96$ $y = -3$ $\therefore E(0, -3)$ $m_{BA} = \frac{6-0}{2-(-1)} = 2$ $m_{CE} = \frac{-3-2}{0-3} = \frac{5}{3}$ $m_{BA} \neq m_{CE}$ $\therefore BA$ adalah tidak selari dengan CE. *BA is not parallel to CE.*	1 1 1 1 1 1 1	**10**

Kertas 1

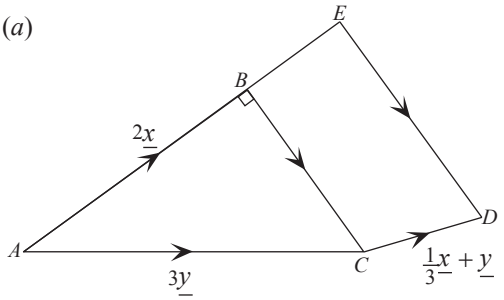
Bahagian A

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
1	(*a*) $\lvert \overrightarrow{ED} + \overrightarrow{DB} + \overrightarrow{BE} = 0$	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
2	$\overrightarrow{OP} = 2\underline{i} + 3\underline{j}$ $\overrightarrow{OQ} = q\underline{i} + 2q\underline{j}$ $\overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OQ}$ $= -2\underline{i} - 3\underline{j} + q\underline{i} + 2q\underline{j}$ $= (-2 + q)\underline{i} + (-3 + 2q)\underline{j}$ 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
3	(*a*) $\overrightarrow{SP} = -2\underline{i} + 3\underline{j}$	1	
	(*b*) (i) $\overrightarrow{SP} + 3\overrightarrow{PQ} = 13\underline{i} + 15\underline{j}$ $(-2\underline{i} + 3\underline{j}) + 3(5\underline{i} + m\underline{j}) = 13\underline{i} + 15\underline{j}$ $-2\underline{i} + 3\underline{j} + 15\underline{i} + 3m\underline{j}) = 13\underline{i} + 15\underline{j}$ $13\underline{i} + (3m + 3)\underline{j} = 13\underline{i} + 15\underline{j}$ $3m + 3 = 15$ $3m = 12$ $m = 4$	1 1 1	

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
	(ii) $\overrightarrow{PQ} = 5\underline{i} + 4\underline{j}$ $\lvert\overrightarrow{PQ}\rvert = \sqrt{5^2 + 4^2}$ $\lvert\overrightarrow{PQ}\rvert = \sqrt{41}$ Vektor unit / *Unit vector* $= \dfrac{5\underline{i} + 4\underline{j}}{\sqrt{41}}$	1	**5**

Kertas 2

Bahagian A

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
1	(*a*) (i) $\overrightarrow{OX} = \overrightarrow{OA} + \overrightarrow{AX}$ $= 4\underline{a} + \underline{b}$ (ii) $\overrightarrow{BY} = \overrightarrow{BA} + \overrightarrow{AY}$ $= -3\underline{b} + (-\underline{a})$ $= -3\underline{b} - \underline{a}$	1 1 1	
	(*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 $-4 + 4(3 - 3k) = -k$ $-4 + 12 - 12k = -k$ $k = \dfrac{8}{11}$ $\overrightarrow{BP} = \dfrac{8}{11}\overrightarrow{BY}$ $BP : PY = 8 : 3$	1 1 1 1 1	**8**
2	(*a*)  (i) $\overrightarrow{BC} = \overrightarrow{BA} + \overrightarrow{AC}$ $\overrightarrow{BC} = -\overrightarrow{AB} + \overrightarrow{AC}$ $\overrightarrow{BC} = -2\underline{x} + 3\underline{y}$	 1 1	

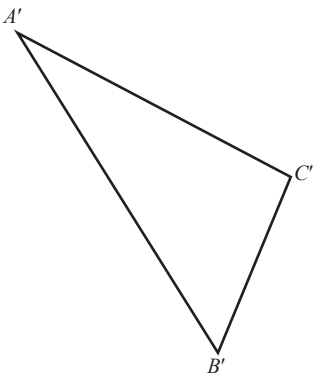
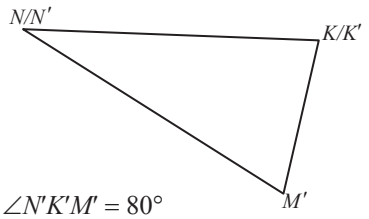
No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
	(ii) $\overrightarrow{ED} = \overrightarrow{EA} + \overrightarrow{AC} + \overrightarrow{CD}$ $\overrightarrow{ED} = -\overrightarrow{AE} + \overrightarrow{AC} + \overrightarrow{CD}$ $\overrightarrow{ED} = -\frac{3}{2}\overrightarrow{AB} + 3\underline{y} + \frac{1}{3}\underline{x} + \underline{y}$ $\overrightarrow{ED} = -\frac{3}{2}(2\underline{x}) + 4\underline{y} + \frac{1}{3}\underline{x}$ $\overrightarrow{ED} = -3\underline{x} + 4\underline{y} + \frac{1}{3}\underline{x}$ $\overrightarrow{ED} = 4\underline{y} - \frac{8}{3}\underline{x}$	1	
	(*b*) $\overrightarrow{ED} = -\frac{8}{3}\underline{x} + 4\underline{y}$ $\overrightarrow{ED} = \frac{4}{3}\left(-2\underline{x} + 3\underline{y}\right)$ $\overrightarrow{ED} = \frac{4}{3}\left(\overrightarrow{BC}\right)$ $\therefore \overrightarrow{ED} = \frac{4}{3}\overrightarrow{BC}$ $\therefore \overrightarrow{ED} \,//\, \overrightarrow{BC}$	1 1	**5**

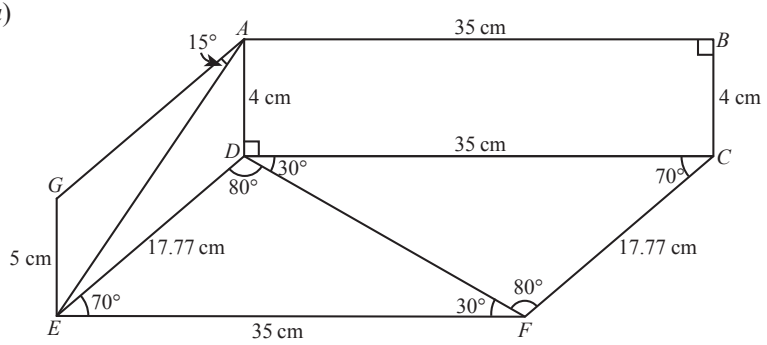
Bahagian B

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
3	(*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	
	(*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**

Kertas 2

Bahagian C

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
1	(*a*) (i) $\frac{1}{2}(2.8)(3)\sin 143° = \frac{1}{2}(3)(3.6)\sin \angle BCD$	1	
	$\angle BCD = 152.09°$	1	
	(ii) $AC^2 = 2.8^2 + 3^2 - 2(2.8)(3)$ kos / cos 143°	1	
	$AC = 5.50$ cm	1	
	$CE = 5.50 - 4 = 1.50$ cm	1	
	(iii) $\frac{2.8}{\sin \angle BCA} = \frac{5.50}{\sin 143°}$	1	
	$\sin \angle BCA = 0.3064$		
	$\angle BCA = 17.84°$	1	
	$BE^2 = 3^2 + 1.5^2 - 2(3)(1.5)$ kos / cos 143°		
	$BE = 1.64$ cm	1	
	(*b*) (i) 	1	
	(ii) $\angle A'B'C' = 37°$	1	**10**
2	(*a*) (i) $(\sqrt{p})^2 = 10^2 + 12^2 - 2(10)(12)\cos 60°$	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**

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
3	(*a*)  (i) $\frac{CF}{\sin 30°} = \frac{35}{\sin 80°}$ $CF = \frac{35 \sin 30°}{\sin 80°}$ $CF = 17.77$ cm (ii) $AC = \sqrt{35^2 + 4^2}$ $AC = 35.23$ cm $CE^2 = 35^2 + 17.77^2 - 2(35)(17.77)$ kos / cos 110° $CE = \sqrt{1\,966.2118}$ $CE = 44.34$ cm $AE^2 = 4^2 + 17.77^2 - 2(4)(17.77)$ kos / cos 90° $AE = \sqrt{331.7729}$ $AE = 18.21$ cm $s = \frac{35.23 + 44.34 + 18.21}{2}$ $= 48.89$ Luas ΔACE / *Area of* ΔACE $= \sqrt{s(s-a)(s-b)(s-c)}$ $= \sqrt{48.89(48.89 - 35.23)(48.89 - 44.34)(48.89 - 18.21)}$ $= 305.33$ cm^2	1 1 1 1 1 1	
	(*b*) $\frac{\sin \angle AGE}{18.21} = \frac{\sin 15°}{5}$ $\sin \angle AGE = 0.9426$ $\angle AGE = \sin^{-1}(0.9426)$ $\angle AGE = 70.49°$ $\angle GEA = 180° - 15° - 70.49°$ $= 94.51°$ $\frac{AG}{\sin 94.51°} = \frac{5}{\sin 15°}$ $AG = \frac{5 \sin 94.51°}{\sin 15°}$ $AG = 19.26$ cm	1 1 1 1	**10**

Kertas 2

Bahagian C

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
1	(*a*) (i) $x = 80$	1	
	(ii) $\frac{2.00}{y} \times 100 = 80$	1	
	$y = \text{RM}2.50$	1	
	(*b*) $\bar{I}_{20/18} = \frac{108 \times 60 + 104 \times 35 + 80 \times 5}{100}$	2	
	$= 105.20$	1	
	(*c*) $I_{21/20} = 140$	1	
	$I_{21/18} = \frac{105.20 \times 140}{100}$		
	$= 147.28$	1	
	$\frac{(43-5)}{P_{18}} \times 100 = 147.28$	1	
	$P_{18} = \text{RM}25.80$	1	**10**
2	(*a*) (i) $\frac{z}{15}(100) = 130$	1	
	$z = \text{RM}19.50$	1	
	(ii) $\frac{y}{x}(100) = 140, x + 6 = y$		
	$140x = (x + 6)100$	1	
	$x = \text{RM}15$		
	$15 + 6 = y$		
	$y = \text{RM}21$	1	
	(*b*) $\frac{130(5) + 140p + 160q + 110(3)}{(5 + p + q + 3)} = 132$	2	
	$980 + 140p + 160q = 1\,056 + 132p + 132q$		
	$8p = 1\,056 - 980 - 28q$		
	$p = \frac{19}{2} - \frac{7}{2}q$	1	
	(*c*) $\bar{I} = \frac{132 \times 120}{100}$		
	$= 158.4$	1	
	$\frac{x}{\text{RM}40} \times 100 = 158.4$		
	$x = \text{RM}63.36$	1	
	Harga biskut tahun 2022 / *Biscuit's price in* 2022		
	$= \frac{115}{100} \times \text{RM}63.36$		
	$= \text{RM}72.86$	1	**10**

No.	Skema Pemarkahan *Marking Scheme*	Markah *Marks*	Jumlah Markah *Total Marks*
3	(*a*) $x = \frac{27.5}{25} \times 100$ $= 110$	1	
	$\frac{22.5}{y} \times 100 = 150$	1	
	$\frac{22.5}{y} = 1.5$ $y = 15$	1	
	(*b*) $\frac{(3)(110) + (2)(112.5) + (m)(150) + (4)(120)}{3 + 2 + m + 4} = 127.5$	1	
	$\frac{1\,035 + 150m}{9 + m} = 127.5$ $1\,035 + 150m = 1\,147.5 + 127.5m$ $225m = 112.5$ $m = 5$	1	
	(*c*) (i) $\bar{I}_{2025/2021} = 127.5 \times \frac{120}{100}$ $\bar{I}_{2025/2021} = 153$	1	
	(ii) $\frac{P_{2025}}{100} \times 100 = 153$ $P_{2025} = \text{RM}153$	1	
	(iii) $\frac{(3)(110) + (2)(112.5) + (5)(I_C) + (4)(120)}{3 + 2 + 5 + 4} = 153$	1	
	$\frac{1\,035 + 5I_C}{14} = 153$ $1\,035 + 5I_C = 2\,142$ $5I_C = 1\,107$ $I_C = 221.4$		
	$\frac{P_{2025}}{15} \times 100 = 221.4$ $P_{2025} = \text{RM}33.21$	1	
	$\frac{33.21 - 15}{15} \times 100\% = 121.4\%$	1	**10**