



**MAJLIS PENGETUA SEKOLAH MALAYSIA (MPSM)
CAWANGAN KELANTAN**

**PERCUBAAN SPM
2021**

**MATEMATIK TAMBAHAN
KERTAS 2**

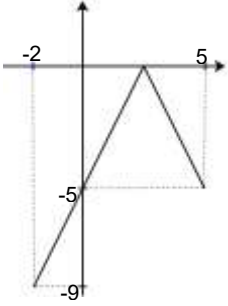
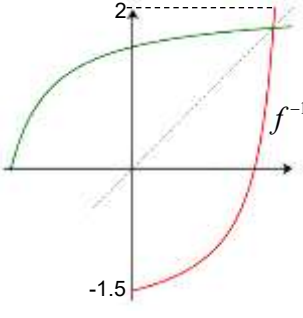
UNTUK KEGUNAAN PEMERIKSA SAHAJA

**SKEMA
PEMARKAHAN**

PERATURAN PEMARKAHAN

KERTAS 2

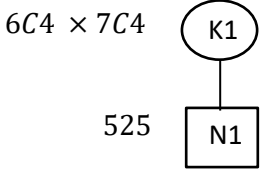
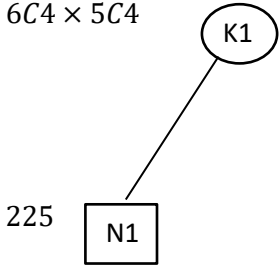
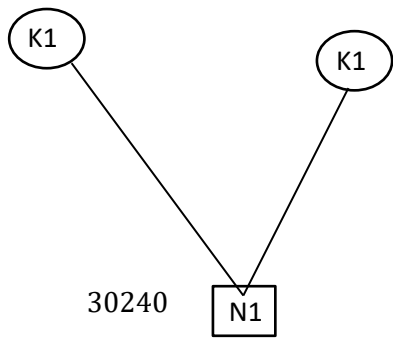
NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS
1 (a)	$Q(p, p^2) \text{ or } L = \sqrt{(p+1)^2 + (p^2)^2} \quad \text{K1}$ $L = [(p+1)^2 + p^4]^{\frac{1}{2}} \text{ unit} \quad \text{N1}$	2	
(b)	$\frac{dL}{dp} = \frac{(p+1) + 2p^3}{\sqrt{(p+1)^2 + p^4}} \quad \text{K1}$ <p style="text-align: right;"><i>Substitute p=1 into $\frac{dL}{dp}$</i></p> <p style="text-align: right;"><i>or $\frac{dL}{dp} = \frac{4\sqrt{5}}{5}$ (implied)</i></p> <p><i>Use chains rule $\frac{dL}{dt} = \frac{dL}{dp} \times \frac{dp}{dt}$</i> K1</p> $\frac{dL}{dt} = 8\sqrt{5} \text{ units}^{-1} \text{ or } 17.8885 \text{ units}^{-1} \quad \text{N1}$	4	6

NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS
2 (a)	<div data-bbox="232 327 1052 682" style="border: 1px solid black; padding: 10px; margin-bottom: 20px;">  <p style="text-align: center;"><i>Range of $f(x) = - 2x-5$ is $-9 \leq f(x) \leq 0$</i></p> </div> <p>Modulus graph N1</p> <p>$(-2, -9)$, $(\frac{5}{2}, 0)$ and $(5, -5)$ N1</p> <p><i>Range of $f(x) = - 2x-5$ is $-9 \leq f(x) \leq 0$</i> N1</p> <div data-bbox="232 1081 751 1438" style="border: 1px solid black; padding: 10px; margin-top: 20px;"> <p>(b)</p>  </div> <div style="text-align: center; margin-top: 20px;"> K1 N1 N1 </div> <p style="text-align: center;"><i>Domain $0 \leq x \leq \frac{7}{4}$</i></p> <p style="text-align: center;"><i>Range $-1.5 \leq f^{-1}(x) \leq 2$</i></p>	3	6

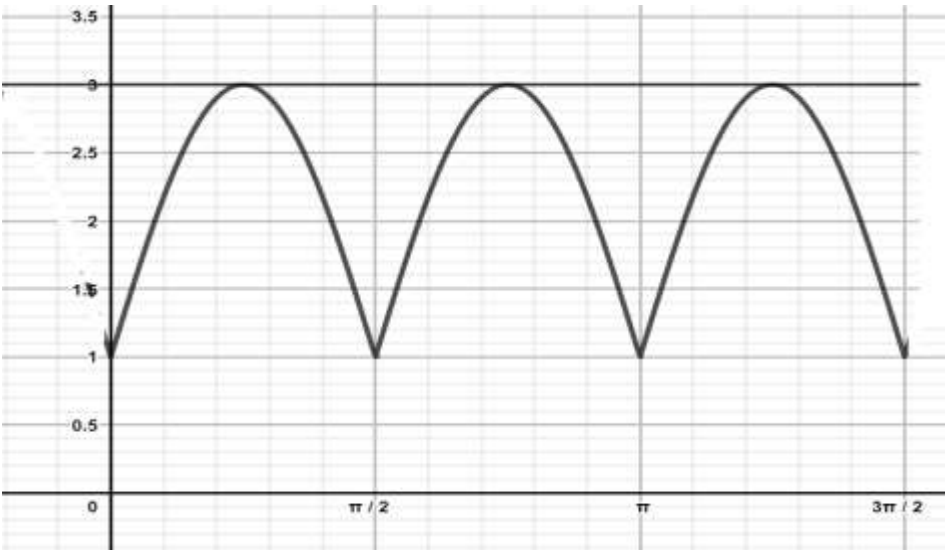
NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS
3 (a)	$= -\frac{1}{2}\vec{b} + \vec{a} \quad \boxed{\text{N1}}$ $= \frac{1}{3}\vec{a} + \frac{2}{3}\vec{b} \quad \boxed{\text{N1}}$	2	
(b)	$\vec{OE} = h\left(\frac{1}{3}\vec{a} + \frac{2}{3}\vec{b}\right) \text{ OR } \vec{OE} = \vec{b} + k\left(-\frac{1}{2}\vec{b} + \vec{a}\right) \quad \textcircled{\text{K1}}$ $= \frac{1}{3}h\vec{a} + \frac{2}{3}h\vec{b} \quad \boxed{\text{N1}} \quad \boxed{\text{N1}} = k\vec{a} + \left(1 - \frac{1}{2}k\right)\vec{b}$	3	
(c)	$\frac{1}{3}h\vec{a} + \frac{2}{3}h\vec{b} = k\vec{a} + \left(1 - \frac{1}{2}k\right)\vec{b} \quad \textcircled{\text{K1}}$ $\frac{1}{3}h = k \text{ or } \frac{2}{3}h = 1 - \frac{1}{2}k \quad \textcircled{\text{K1}}$ $k = \frac{2}{5} \text{ and } h = \frac{6}{5} \quad \boxed{\text{N1}}$	3	8

NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS
4 (a)	$\frac{10}{2}[2a + (10-1)d] = 820 \text{ or } \frac{20}{2}[2a + (20-1)d] = 1240$ <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>(K1)</p> <p>(K1)</p> <p>(N1)</p> <p>(N1)</p> </div> <div style="text-align: left;"> <p>Solve Simultaneous equation</p> $2a - 9d = 164$ $2a - 19d = 124$ </div> </div> <p>$d = 4, a = 100$</p> <p>$d = 4, a = 100$</p>	4	
(b)	$n = 13$ (N1)	1	
(c)	$T_{10} = *100 + (10-1)(* - 4) \text{ or } T_{20} = *100 + (20-1)(* - 4)$ (K1) $64 - 24 = 40\text{cm}$ (N1)	2	7

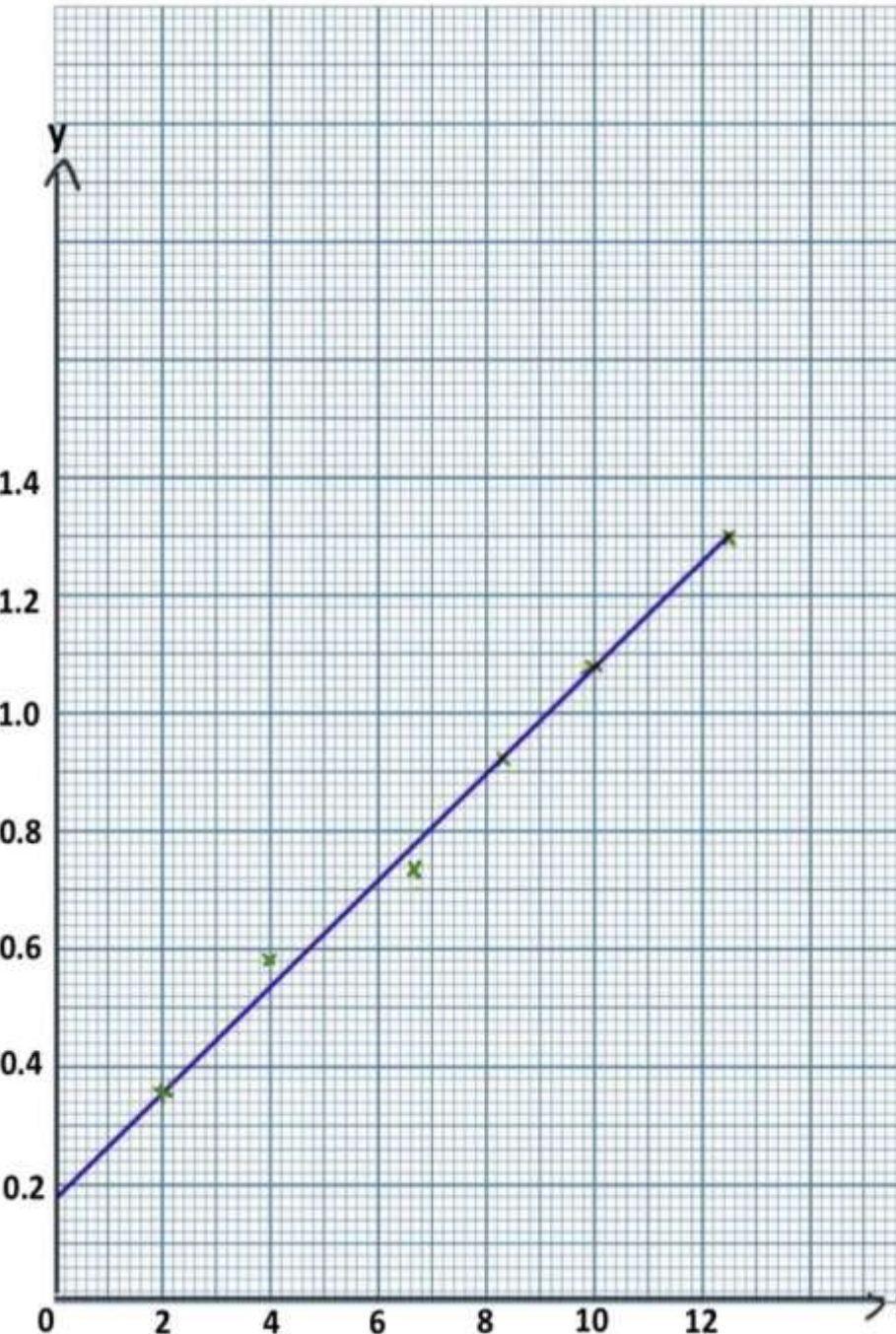
NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS
5 (a)(i)	$y - 5 = \frac{3}{5}(x - 2) \text{ or } \frac{y-5}{x-2} = \frac{3}{5}$ <div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: center;"> <p>(K1)</p> <p>(K1)</p> <p>(N1)</p> </div> <div style="margin-left: 20px;"> $-\frac{5}{3}x + \frac{8}{3} = \frac{3}{5}x + \frac{19}{5}$ </div> </div> $B\left(-\frac{1}{2}, \frac{7}{2}\right)$	3	
(ii)	$4^2 - 4(1)(t^2 - 6t - 3) = 0$ <div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: center;"> <p>(K1)</p> <p>(K1)</p> <p>(N1)</p> </div> <div style="margin-left: 20px;"> $(t + 1)(t - 7) = 0$ </div> </div> $t = -1 \text{ and } t = 7$	3	
(b)	$\tan \theta_1 = \frac{BC}{AB} \text{ or } \tan \theta_2 = -\frac{AB}{BC} \text{ or } \tan \theta_2 = -\frac{1}{\tan \theta_1}$ <div style="display: flex; align-items: center; justify-content: center; margin-top: 20px;"> <div style="text-align: center;"> <p>(N1)</p> </div> <div style="margin-left: 20px;"> <p>(K1)</p> </div> </div> $m_1 \times m_2 = \tan \theta_1 \times \tan \theta_2$ $= \frac{BC}{AB} \times -\frac{AB}{BC} \text{ or } \tan \theta_1 \times -\frac{1}{\tan \theta_1}$ $= -1 \text{ (showed)}$	2	8

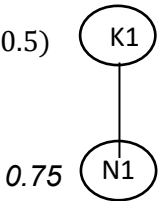
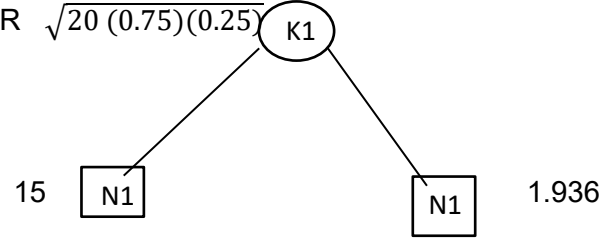

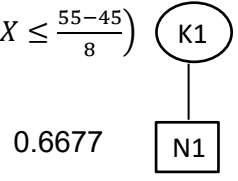
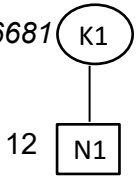
NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS
6 (a)	$6C4 \times 7C4$ 	2	
(b)	$6C4 \times 2C2 \times 5C2 + 6C4 \times 5C4$ 	2	
(c)	$2! \times 6! \times 7$ OR $2P2 \times 6P6 \times 7$ 	3	7

$$8! - (2! \times 6! \times 7!)$$

NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS
7 (a)	$2 \cos^2 \theta - 1$ <div style="text-align: center;"> K1 </div> $2(2 \sin \theta \cos \theta)$ <div style="text-align: center;"> N1 </div>	2	
(b)	 <p>Shape of $\sin 2\theta$ N1</p> <p>Max and min $y = 2\sin 2\theta$ N1</p> <p>$1\frac{1}{2}$ cycles for $0 \leq x \leq \frac{3}{2}\pi$ N1</p> <p>Modulus graph and shifted 1 N1</p>	4	
(c)	$2k - 4 = 3$ <div style="text-align: center;"> N1 </div> $k = \frac{7}{2}$ <div style="text-align: center;"> N1 </div>	2	8

NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS							
8 (a)	<table border="1" style="width: 100%; text-align: center;"> <tr> <td>$\frac{1}{x}$</td> <td>2</td> <td>4</td> <td>6.67</td> <td>8.33</td> <td>10</td> <td>12.5</td> </tr> </table>	$\frac{1}{x}$	2	4	6.67	8.33	10	12.5	N1	
$\frac{1}{x}$	2	4	6.67	8.33	10	12.5				
(b)	<p>Plot y against $\frac{1}{x}$ (Correct axes and uniform scales) K1</p> <p>6 *points plotted correctly N1 If table not shown, all the points are correctly plotted award N1</p> <p>Line of best fit (At least *5 points plotted) N1</p>	3								
(c)(i)	<p>$n = 0.18 \pm 0.1$ $y = \frac{m}{x} + n^2$ P1</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>$m = 0.08 \pm 0.1$ N1</p> </div> <div style="text-align: center;"> <p>$\frac{1}{x} = 8$ K1</p> <p>0.9 N1</p> </div> <div style="text-align: center;"> <p>$n^2 = c$ K1</p> <p>$n = 0.42 \pm 0.1$ N1</p> </div> </div>	6	10							

NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS																
8 (b)	 <p>The graph shows a straight line on a coordinate plane. The y-axis is labeled 'y' and has major tick marks at 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, and 1.4. The x-axis has major tick marks at 0, 2, 4, 6, 8, 10, and 12. A blue line is drawn, starting at the y-intercept (0, 0.2) and passing through several points marked with green 'x's. The points are approximately (2, 0.35), (4, 0.58), (6, 0.73), (8, 0.92), (10, 1.08), and (12, 1.32).</p> <table border="1"><thead><tr><th>x</th><th>y</th></tr></thead><tbody><tr><td>0</td><td>0.2</td></tr><tr><td>2</td><td>0.35</td></tr><tr><td>4</td><td>0.58</td></tr><tr><td>6</td><td>0.73</td></tr><tr><td>8</td><td>0.92</td></tr><tr><td>10</td><td>1.08</td></tr><tr><td>12</td><td>1.32</td></tr></tbody></table>	x	y	0	0.2	2	0.35	4	0.58	6	0.73	8	0.92	10	1.08	12	1.32		
x	y																		
0	0.2																		
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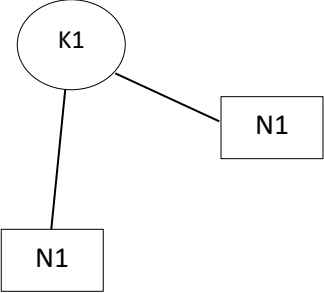
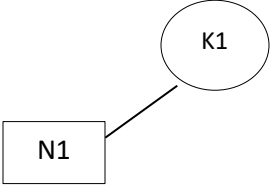
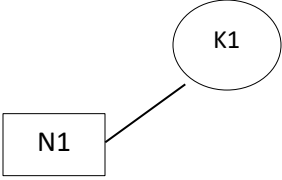
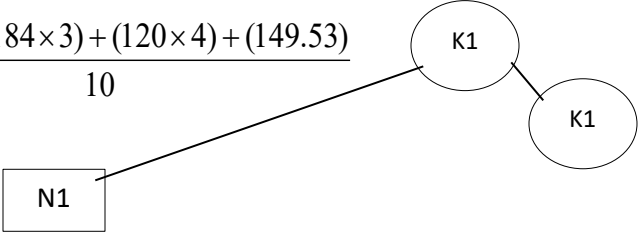
NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS
9 (a)(i)	$3C1(0.5)(0.5)^2 + 3C2(0.5)^2(0.5)$ 	2	
(ii)	$20(0.75)$ OR $\sqrt{20(0.75)(0.25)}$ 	3	
(b)(i)	39 	1	
(ii)	$P\left(\frac{39-45}{8} \leq X \leq \frac{55-45}{8}\right)$ 	2	
(iii)	$P\left(X \leq \frac{33-45}{8}\right)$ OR 0.06681 	2	10

NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS
10 (a)(i)	$2x(x - 4) = 0$ <div style="text-align: center;"> K1 $A(4, 0)$ N1 </div>	2	
(ii)	$f(x) = \frac{2}{3}x^3 - 4x^2 + c$ <div style="text-align: center;"> K1 $0 = \frac{2}{3}(4)^3 - 4(4)^2 + c$ N1 </div> $f(x) = \frac{2}{3}x^3 - 4x^2 + \frac{64}{3}$ <div style="text-align: center;"> N1 </div>	3	
(b)(i)	$B\left(0, \frac{64}{3}\right)$ <div style="text-align: center;"> N1 </div>	1	
(ii)	$\frac{64}{3} \times 6 \quad \text{or} \quad \left[\frac{64x}{3}\right]_0^6$ <div style="text-align: center;"> K1 K1 $\left[\frac{x^4}{6} - \frac{4x^3}{3} + \frac{64x}{3}\right]_0^6$ </div>		
(iii)	$\frac{64}{3} \times 6 - \left[\frac{x^4}{6} - \frac{4x^3}{3} + \frac{64x}{3}\right]_0^6$ <div style="text-align: center;"> K1 72 unit^2 N1 </div>	4	10

NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS
11	<p>(a) Use trigonometry ratio</p> <hr/> <p>$\tan \square = \frac{9}{15}$</p> <p>0.5404</p> <p>(P1) — (N1)</p> <p>(b) $AT = 15 - r$ or $AS = 15 - r$</p> <p>(P1)</p> <p>Use trigonometry ratio for angle $\frac{1}{2}^*$ (\square BAC)</p> <hr/> <p>$\tan 15.48^\circ = \frac{r}{15 - r}$</p> <p>3.253</p> <p>(N1) — (K1)</p> <p>(c) <u>Find ST</u></p> <p>$ST = 3.253(2.602)$</p> <p>Perimeter</p> <p>$8.463 + 3.253 + 3.253$</p> <p>14.96</p> <p>(N1) — (K1) — (K1)</p> <p>(d) Use area formulae</p> <p>$A = \frac{1}{2}(3.253)^2(2.602)$</p> <p>13.77</p> <p>(K1) — (N1)</p>	<p>2</p> <p>3</p> <p>3</p> <p>2</p>	<p>10</p>

NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS
12	<p>(a) $25m + 5n = 0$ or $5m+n=0$ (P1)</p> <p>$a = 2mt + n$</p> <p>$2m+n = 3$</p> <p>$m = -1$</p> <p>$n = 5$</p> <div style="text-align: center;"> <pre> graph TD K1_top((K1)) --- K1_mid((K1)) K1_top --- N1_bottom[N1] K1_top --- N1_right[N1] K1_top --- N1_mid[N1] </pre> </div> <p>(b) $-t^2 + 5t > 0$</p> <p>$0 < t < 5$</p> <div style="text-align: center;"> <pre> graph TD K1((K1)) --- N1[N1] </pre> </div> <p>(c) $S = -\frac{t^3}{3} + \frac{5t^2}{2}$ (P1)</p> <p>Use $S_{t=5} - S_{t=4}$</p> <p>2.167</p> <div style="text-align: center;"> <pre> graph TD N1[N1] --- K1((K1)) </pre> </div>	<p>5</p> <p>2</p> <p>3</p>	<p>10</p>

NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS
13	(a) $x \leq 60$ N1		
	$Y \leq 50$ N1		
	$30x + 20y \geq 1500$ N1		
	$x \geq y$ N1	4	
	(b) – at least 1 graph P1		
	-The all graph N1		
	-shaded region correctly N1	3	
	(c) Minimum point (30, 30) N1		
	$8000x + 4000y$ K1		
	360 N1	3	10

NO	SOLUTION AND MARK SCHEME	SUB MARKS	TOTAL MARKS
15	<p>(a) $\frac{1}{125} \times 184 \times 100$</p> <p>$p = 47.2$</p> <p>$\frac{130 \times 115}{100}$</p> <p>$q = 149.5$</p>  <p>(b) $\frac{160 \times 100}{110}$</p> <p>145.45</p>  <p>$\frac{120 \times 100}{90}$</p> <p>133.33</p>  <p>(c)</p> <p>$\bar{I} = \frac{(160 \times 1) + (184 \times 3) + (120 \times 4) + (149.53)}{10}$</p> <p>149</p> 	3	
		4	
		3	10