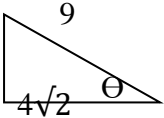
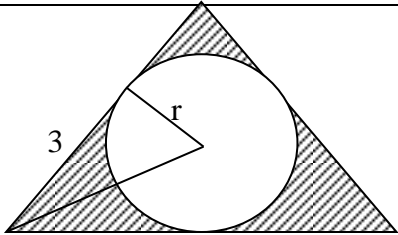


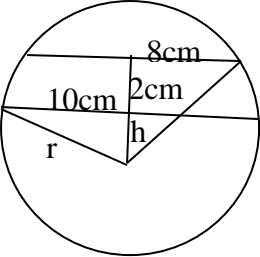
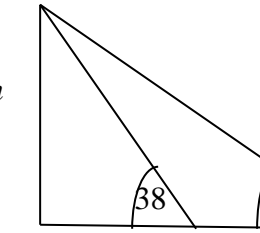
121/1 Mathematics (2017)

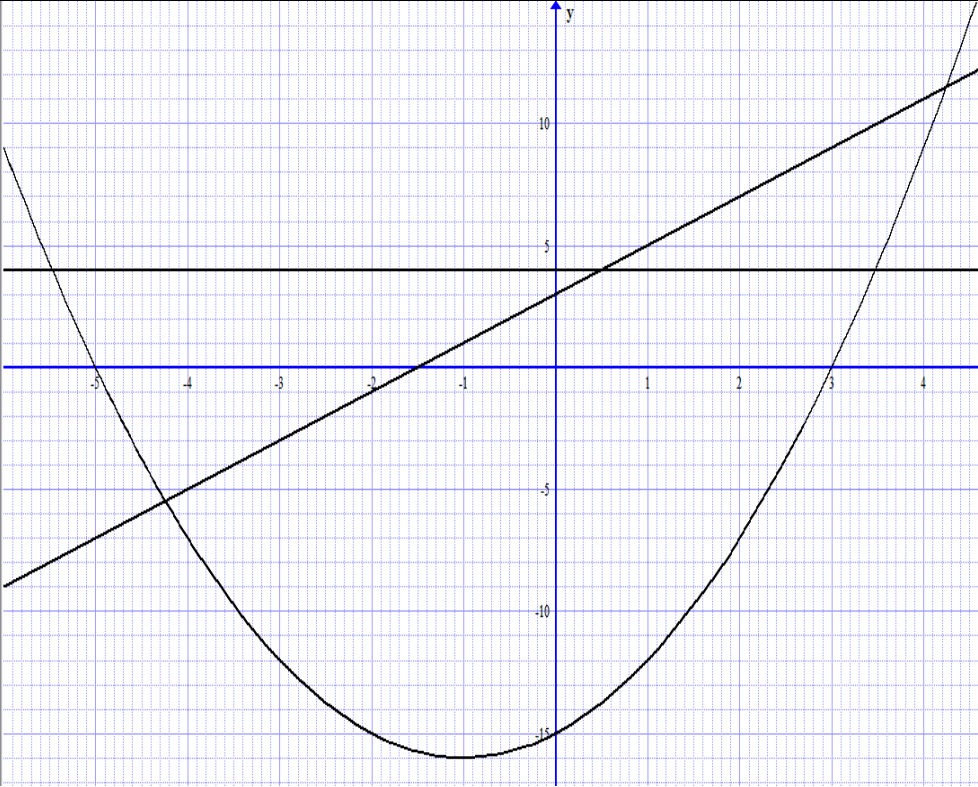
PAPER 1

MARKING SCHEME

	<i>SOLUTION</i>	<i>MA RK</i>	<i>REMARK</i>
1.	$= \sqrt{\frac{1408 \times 594 \times 12}{605 \times 125 \times 10^4}}$ $= \sqrt{\frac{2^7 \times 11 \times 2 \times 3^3 \times 11 \times 2^2 \times 3}{5 \times 11^2 \times 5^3 \times 10^4}}$ $= \frac{2^5 \times 3^2}{5^2 \times 10^2} = \frac{72}{125}$	MI MI AI	
		3	
2.	$\text{percentage change} = \left(\frac{5}{3} \times 0.85 \right) \times 100\% - 100\%$ $= 141.67\% - 100\%$ $= 41.67\%$	MI AI	
		2	
3.	$= \frac{27(3^n) - 3(3^n)}{36(3^n)}$ $= \frac{24(3^n)}{36(3^n)}$ $= \frac{2}{3}$	MI MI AI	
		3	
4.	$\log_2 y = \log_2 (3 \times 7 \times y^2)$ $y = 21y^2$ $y = 0 \text{ or } \frac{1}{21}$ <p>ignore $y=0$</p>	MI MI AI	
		3	
5.	$\frac{1}{3} \pi \times 5^2 \times h = \frac{4}{3} \pi \times 2^3 \times 5$ $25h = 40$ $h = 1.6 \text{ cm}$	MI MI AI	
		3	
6.	$h = \sqrt{81 - (4\sqrt{2})^2} = 7$  $\text{Tan } \theta = \frac{7}{4\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$ $= \frac{7\sqrt{2}}{8}$	BI MI AI	
		3	

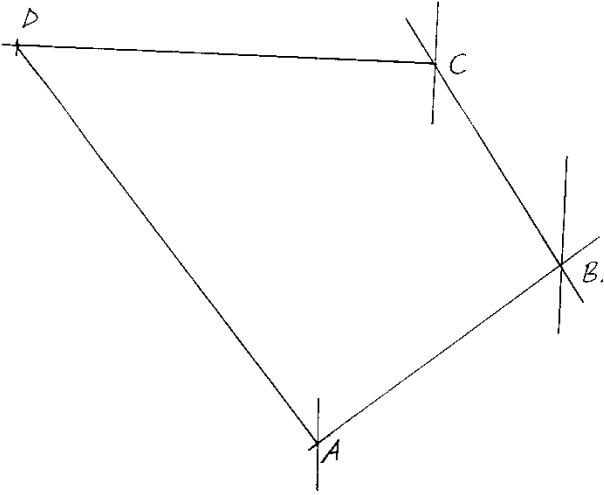
7.	<p><i>correct value</i> = 120% of $x = 1.2x$</p> <p><i>incorrect value</i> = 80% $x = 0.8x$</p> <p><i>percentage change</i> = $\frac{1.2x}{0.8x} \times 100\% - 100\% = 50\%$</p>	M1 M1 A1	
		3	
8.	$= \frac{2^4 \times a^{12} \times b^{20}}{2^4 \times a^8 \times b^4} \times \frac{2^9 \times a^3 \times b^3}{2^{-1} \times a^3 \times b^2}$ $= 2^{10} \times a^4 \times b^{17}$	M1 M1 A1	
		3	
9.	$25 \times 8 \times h = 1000$ $h = \frac{1000}{25 \times 8} = 5\text{cm}$ <p><i>new depth</i> = $15 - 5 = 10\text{cm}$</p>	M1 A1 B1	
		3	
10.	<p><i>cost price</i> = $\frac{270}{120} \times 100 = 225$</p> $\frac{180x + 300y}{x + y} = 225$ $180x + 300y = 225x + 225y$ $45x = 75y$ $\frac{x}{y} = \frac{75}{45} = \frac{5}{3}$ <p><i>ratio</i> 5:3</p>	B1 M1 M1 A1	
		4	
11.	 <p>$\tan 30^\circ = \frac{r}{3}$</p> $r = 3 \tan 30^\circ = 1.732\text{cm}$ <p><i>Area of triangle</i> = $\frac{1}{2} \times 6^2 \sin 60 = 15.59\text{cm}^2$</p> <p><i>area of circle</i> = $3.142 \times 1.732^2 = 9.425\text{cm}^2$</p> <p><i>area shaded</i> = $15.59 - 9.425 = 6.165\text{cm}^2$</p>	B1 M1 A1	
		3	

12.	$r^2 = h^2 + 10^2$ $r^2 = (h+2)^2 + 8^2$ $= h^2 + 4h + 4 + 64$ $h^2 + 100 = h^2 + 4h + 4 + 64$ $4h = 32$ $h = 8$ $r = \sqrt{164} = 12.81cm$		M1 A1 B1																											
			3																											
13.	$\frac{2x^2 + x - 1}{(x-1)(x+1)}$ $= \frac{2x^2 + 2x - x - 1}{(x-1)(x+1)} = \frac{(2x-1)(x+1)}{(x-1)(x+1)}$ $= \frac{2x-1}{x-1}$		M1 M1 A1																											
			3																											
14.	$\begin{pmatrix} 4 \\ 3 \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} -4 \\ 2 \end{pmatrix}$ $T = \begin{pmatrix} -8 \\ -1 \end{pmatrix}$ $\begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} -8 \\ -1 \end{pmatrix} = \begin{pmatrix} -2 \\ -2 \end{pmatrix}$ $B(6, -1)$		B1 M1 A1																											
			3																											
15.	$\tan 22 = \frac{h}{80} \Rightarrow h = 80 \tan 22 = 32.32m$ $\tan 38 = \frac{h}{x} \Rightarrow h = x \tan 38$ $x \tan 38 = 32.32$ $x = \frac{32.32}{\tan 38} = 41.37m$ $dis \tan ce AB = 80 - 41.37 = 38.63m$		M1 M1 A1																											
			3																											
16.	$total \ man \ hours = 10 \times 6 \times 9 = 540manhrs$ $manhours \ done = 4 \times 12 \times 5 = 240manhrs$ $no \ of \ days = \frac{540 - 240}{6 \times 10} = 5days$		M1 M1 A1																											
			3																											
17.	<table border="1"> <tbody> <tr> <td>x</td> <td>-6</td> <td>-5</td> <td>-4</td> <td>-3</td> <td>-2</td> <td>-1</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>y = x²+2x-15</td> <td>9</td> <td>0</td> <td>-7</td> <td>-12</td> <td>-15</td> <td>-16</td> <td>-15</td> <td>-12</td> <td>-7</td> <td>0</td> <td>9</td> <td>20</td> </tr> </tbody> </table>	x	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	y = x ² +2x-15	9	0	-7	-12	-15	-16	-15	-12	-7	0	9	20		B2	For all correct values
x	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5																		
y = x ² +2x-15	9	0	-7	-12	-15	-16	-15	-12	-7	0	9	20																		

	 <p> $y = x^2 + 2x - 15$ $0 = x^2 + 2x - 15$ $\underline{y = 0}$ $x = -5; x = 3$ </p> <p> $y = x^2 + 2x - 15$ $0 = x^2 - 18$ $\underline{y = 2x + 3}$ $x = -4.25; x = 4.25$ </p> <p>$-5.5 \leq x \leq 3.5$</p>	<p>S1 P1 C1 L1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>B1</p>	
		10	
18.	<p> $YZ = 8\text{cm}$ $XZ = 2\sqrt{(8^2 - 6^2)}$ $= 2 \times \sqrt{28} = 10.583\text{cm}$ $\angle WXY = 2 \times \sin^{-1}\left(\frac{6}{8}\right)$ $= 97.18^\circ$ $\text{area} = \frac{1}{2} \times 12 \times 10.58$ $= 63.48\text{cm}^2$ </p>	<p>B1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p>	

19.	x^c	0^c	$\frac{\pi^c}{2}$	π	$\frac{3\pi^c}{2}$	$2\pi^c$	$\frac{5}{2}\pi^c$	$3\pi^c$	$\frac{7}{2}\pi^c$	$4\pi^c$	$\frac{9}{2}\pi^c$		
	$\sin \frac{1}{2}x^c$	0	0.71	1	0.71	0	-0.71	-1	-0.71	0	0.71	B1	
	$3\sin\left(\frac{1}{2}x + \frac{\pi}{3}\right)$	2.60	2.90	1.50	-0.78	-2.60	-2.90	-1.50	0.78	2.60	2.90	B1	
												S1	
	<p>b) a translation vector $\begin{pmatrix} -\frac{\pi}{3} \\ 0 \end{pmatrix}$ followed by a stretch parallel to the y – axis with</p> <p>x – axis invariant, stretch factor 3</p> <p>c) i) amplitude = 3, phase angle $-\frac{\pi}{3}$</p> <p>ii) $x = \frac{10}{9}\pi^c, \frac{28}{9}\pi^c$</p>											B1	
												B1	
												B1	
												B1	
												10	

20.	(a) Value of $y = 100 - (6 + 9 + 12 + 30 + 20 + 6 + 3) = 14$	B1																																																		
	<table border="1"> <thead> <tr> <th></th> <th>Mid. Point x</th> <th>f</th> <th>c.f</th> <th>fx</th> </tr> </thead> <tbody> <tr> <td>0 – 10</td> <td>5</td> <td>6</td> <td>6</td> <td>30</td> </tr> <tr> <td>10 – 20</td> <td>15</td> <td>9</td> <td>15</td> <td>135</td> </tr> <tr> <td>20 – 30</td> <td>25</td> <td>12</td> <td>27</td> <td>300</td> </tr> <tr> <td>30 – 40</td> <td>35</td> <td>30</td> <td>57</td> <td>1050</td> </tr> <tr> <td>40 – 50</td> <td>45</td> <td>20</td> <td>77</td> <td>900</td> </tr> <tr> <td>50 – 60</td> <td>55</td> <td>$y = 14$</td> <td>91</td> <td>770</td> </tr> <tr> <td>60 – 70</td> <td>65</td> <td>6</td> <td>97</td> <td>390</td> </tr> <tr> <td>70 – 80</td> <td>75</td> <td>3</td> <td>100</td> <td>225</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>$\Sigma fx = 3800$</td> </tr> </tbody> </table>		Mid. Point x	f	c.f	fx	0 – 10	5	6	6	30	10 – 20	15	9	15	135	20 – 30	25	12	27	300	30 – 40	35	30	57	1050	40 – 50	45	20	77	900	50 – 60	55	$y = 14$	91	770	60 – 70	65	6	97	390	70 – 80	75	3	100	225					$\Sigma fx = 3800$	B1
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				$\Sigma fx = 3800$																																																
	b) Modal class = 30 – 40	B1																																																		
	(c) $Mean = \frac{3800}{100} = 38$	M1 A1																																																		
	(d) $Median = 30 + \left(\frac{50 - 27}{30} \right) \times 10$ $= 30 + \frac{23}{30} \times 10$ $= 30 + 7\frac{2}{3}$ $= 37.67$	M1 A1																																																		
	(e) $55^{th} \text{ percentile} = 30 + \frac{55 - 27}{30} \times 10$ $= 30 + \frac{28}{30} \times 10$ $= 39.33$	M1 A1																																																		
		10																																																		

21.	$S = 4 - 4t + 2t^2 + t^3$ $v = \frac{ds}{dt} = -4 + 2t + 3t^2$ <p>when $t = \frac{1}{2} s, v = -2\frac{1}{4} m/s$</p> $a = \frac{dv}{dt} = 4 + 6t$ <p>when $t = 0; a = 4 m/s^2$</p> $-4 + 4t + 3t^2 = 0$ $3t^2 + 6t - 2t - 4 = 0$ $3t(t+2) - 2(t+2) = 0$ $(3t-2)(t+2) = 0$ $t = -2, (\text{ignore})$ $t = \frac{2}{3} s$ $\text{displacement} = 4 - 4\left(\frac{2}{3}\right) + 2\left(\frac{2}{3}\right)^2 + \left(\frac{2}{3}\right)^3$ $= 2\frac{14}{27} m$	M1 M1A1 M1 A1 M1 M1 A1 M1 A1	
22.	 <p>a) 134°</p> <p>b) $DA = 12.2 \times 100$ $= 1220 \text{ km}$ $t = 1220/500$ $= 2.44 \text{ hrs}$ $= 2 \text{ hr } 26.4 \text{ min}$ Arrival 10.26am</p>	10 B1 B1 B1 B1 B1 B1 B1 M1 A1 B1 10	locating B distance and angle locating C distance and angle locating D distance and angle

23.	$a) = \frac{180}{360} \times 2 \times \frac{22}{7} \times 6370 \cos 60$ $= 10,010 \text{ km}$ $b) = \left(\frac{30}{360} \times 2 \times \frac{22}{7} \times 6370 \right) \times 2$ $= 6673.33 \text{ km}$ $c) \frac{\theta}{360} \times 2 \times \frac{22}{7} \times 6370 \cos 60 = 420$ $\theta = \frac{420 \times 18}{1001} = 7.552^\circ$ <p style="text-align: center;"><i>Longitude of C = 41°W - 7.552°</i></p> $= 33.45^\circ$ <p style="text-align: center;"><i>location of C (60°N, 33.45°W)</i></p>	M1 A1 M1 M1 A1 M1 A1 M1 A1 A1 B1	
		10	
24.	$a) = 135000 : 216000 : 270000$ $= 5 : 8 : 10$ $b) = \frac{1035000}{2} = \text{Kshs}517,500$ $A's \text{ share} = \frac{5}{23} \times 517500 = \text{Kshs}112,500$ $B's \text{ share} = \frac{8}{23} \times 517500 = \text{Kshs}180,000$ $C's \text{ share} = \frac{10}{23} \times 517500 = \text{Kshs}225,000$ $c) A's \text{ contribution} = 135,000 + 112,500$ $= \text{Kshs}237,500$ $B's \text{ contribution} = 216,000 \times \frac{5}{3}$ $= \text{Kshs}360,000$ $C's \text{ contribution} = 270,000 \times \frac{5}{3}$ $= \text{Kshs}450,000$ <p style="text-align: center;"><i>new ratio = 35 : 144 : 180</i></p> $d) \frac{35}{359} \times x = 350000$ $x = \frac{350000 \times 359}{35} = \text{Kshs}3,590,000$ $\text{profit} = \text{Kshs}3,590,000 \times 2$ $= \underline{\underline{\text{Kshs}7,180,000}}$	B1 B1 B1 B1 M1 M1 A1 M1 A1 B1	
		10	