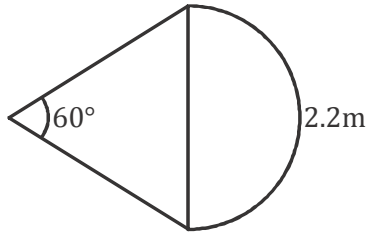


# FORM 4 END OF TERM 2 EXAM

**MATHEMATICS**  
 Paper 2  
 July 2018  
**MARKING SCHEME**

<b><u>SECTION 1</u></b>		
<b>1.</b> $y(p + 3r) = 2p - r$ $yp + 3yr = 2p - r$ $3yr + r = 2p - yp$ $p = \frac{3yr + r}{2 - y}$ or $p = \frac{-r - 3yr}{y - 2}$	M1  M1  A1	
3		
<b>2.</b> $v = c + ku$ $v = c + ku$ $12 = c + k -$ $\underline{23 = c + 12k}$ $-11 = 0 + -11k$  $k = 1 \quad c = 11$ $\therefore v = 11 + k$ $v = 11 + 5$ $= 16$	M1  M1         A1	
3		
<b>3.</b> $\log_{10}(3x + 2) - \log_{10}10 = \log_{10}(x - 4)$  $\frac{3x + 2}{10} = x - 4$ $10(x - 4) = 3x + 2$ $10x - 40 = 3x + 2$ $7x = 42$ $x = 6$	M1     M1    A1	
3		
<b>4.</b> $2x - 1 < 7 + x$ $7 + x \leq 3x + 2$ $x < 8$ $5 \leq 2x$  $2.5, 3, 4, 5, 6, 7$ $2.5 \leq x$	M1    M1 A1	each expression integral values
3		

5.



$$L = \frac{\theta}{360} + 2\pi r$$

$$2.2 = \frac{60}{360} \times 2 \times \frac{22}{7} \times r$$

$$r = \frac{2.2 \times 360 \times 7}{60 \times 44}$$

$$\left( \frac{r = 2.1}{\frac{60}{360} \times \frac{22}{7} \times 2.1^2} \right) - \frac{1}{2} (2.1^2 \sin 60^\circ)$$

$$2.23 - 1.9095 = 0.4004$$

B1  
M1M1

A1  
4

6. Max area  $\frac{1}{2} \times 8.25 \times 6.35 = 26.19375$   
 Min area  $\frac{1}{2} \times 8.15 \times 6.25 = 25.46875$   
 Actual  $\frac{1}{2} \times 8.2 \times 6.3 = 25.83$

$$\frac{\text{Max} - \text{min}}{2} = \frac{26.19375 - 25.46875}{2}$$

$$\frac{0.3625}{25.84} \times 100\% = 1.403\%$$

M1

M1

A1

3

7. Tap A  $\frac{1}{8} \times 2 = \frac{1}{4}$  Tap B  $\frac{1}{10} \times 1 = \frac{1}{10}$

$$\frac{1}{4} + \frac{1}{10} = \frac{10 + 4}{40} = \frac{7}{20}$$

$$\text{Remaining part } \frac{13}{20}$$

$$\text{in a minute } \frac{1}{8} + \frac{1}{10} = \frac{9}{40}$$

$$\frac{13}{20} \times \frac{40}{9} = \frac{26}{9} \quad 2\frac{8}{9} \text{ min}$$

or time 2 min 53 sec.

M1

remaining empty part

M1

A1

3

8.  $Ax \times Bx = Cx + Dx$

$$13 \times 5 = (6 + y) \times 6$$

$$65 = 36 + 6y$$

$$29 = 6y$$

$$y = 29$$

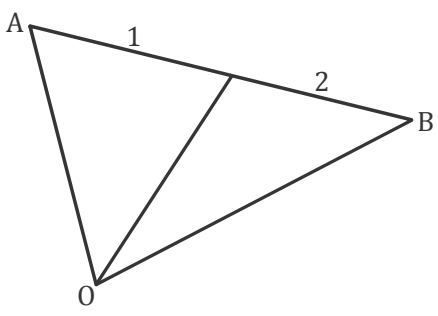
$$6$$

$$y = 4.8\text{cm}$$

M1

A1  
2

C.A.O

<p>9.</p> $\frac{1}{\frac{1}{2} - \frac{1}{\sqrt{2}}} \times \frac{\frac{1}{2} + \frac{1}{\sqrt{2}}}{\frac{1}{2} + \frac{1}{\sqrt{2}}}$ $\frac{\frac{1}{2} + \frac{1}{\sqrt{2}}}{\frac{1}{4} - \frac{1}{2}} = \frac{\frac{1}{2} + \frac{1}{\sqrt{2}}}{-\frac{1}{2}}$ $= -1 - \frac{2}{\sqrt{2}}$	<p>M1</p> <p>M1</p> <p>A1</p> <p>3</p>
<p>10. i) <math>1^5 - 5(3x) + 1^3 \times 10(3x)^2 - 1^2 \times 10(3x)^3 + (3x)^4 \times 5 + (3x)^5</math>  <math>1 - 15x + 90x^2 - 270x^3 + 405x^4 - 243x^5</math>  <math>1 - 15x + 90x^2 - 270x^3</math></p> <p>ii) <math>(0.97)^5 = (1 - 0.03)^5</math>  <math>3x = 0.03</math>  <math>x = 0.01</math>  <math>1 - 15(0.01) + 90(0.01)^2 - 270(0.01)^3</math>  <math>= 0.8587</math></p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>4</p>
<p>11. <math>ASF = \frac{60}{10} = \frac{6}{1}</math>  <math>(y \times 4) - 2(y - 1) = 6</math>  <math>4y - 2y + 2 = 6</math>  <math>2y = 4</math>  <math>y = 2</math></p>	<p>B1</p> <p>M1</p> <p>A1</p> <p>3</p>
<p>12.</p>  <p><math>OP = OA + \frac{1}{3}AB</math>  <math>AB = AO + OB</math>  <math>-3i - 2j + 4k + 4i + 3j - 2k</math>      M1  <math>i + 3j + 2k</math>  <math>OP = OA + \frac{1}{3}AB</math>      M1  <math>OP = (3i + 2j - 4k) + \frac{1}{3}(i + 3j + 2k)</math>  <math>= \frac{1}{3}(10i + 9j - 10k)</math></p>	<p>A1</p> <p>3</p>

<b>13.</b> $\cos 4x = -1/2$ $\cos^{-1} 1/2 = 60^\circ$ $x = 30^\circ, 127.5^\circ, 150^\circ$	B1 B1 B1 3	
<b>14. i)</b> $\frac{x}{8} = \frac{2}{x}$ $x^2 = 16$ $x = 4$ $x = -4$  <b>ii)</b> $r = -1/2$ $8^{1/4} \div 3^{1/2}$  $S_n = \frac{8(1 + (1/2)^5)}{(1 + 1/2)}$ $\frac{33}{4} \times \frac{2}{3}$  $= \frac{1/4 + 8}{3^{1/2}}$ $11 = 5^{1/2}$	M1  A1   M1  A1  4	  both values    substitution
<b>15.</b> $P = 300,000 - 75000$ $= 225,000$ $A = 225,000 \times 1.15^{1.25}$ $= \frac{225,000 \times 1.15^{1.25}}{15}$ $\frac{225000 \times 1.190}{15} = \frac{267950}{15}$ Ksh.17863	M1 A1  M1   A1 4	      for monthly instalment
<b>16.</b> $\left( \frac{1 + -3}{2}, \frac{5 + 7}{2} \right) = (-1, 6)$  $v = \sqrt{(1 - -1)^2 + (5 - 6)^2}$ $\sqrt{5}$ $(x + 1)^2 + (y - 6)^2 = 5$	B1   M1  A1 3	

**SECTION II**

17. a) i) Elder child - y  
Younger child  $\Rightarrow (y - 5)$  years

B1

ii)  $2(y + y - 5) = (4y - 10)$  years

B1

b) In 20 years time

i) elder child  $\Rightarrow (y + 20)$  years

younger child  $\Rightarrow y - 5 + 20$   
 $= (y + 15)$  yrs

Parent  $= 4y - 10 + 20$   
 $= (4y + 10)$  yrs

$(y + 20)(y + 15) = 15(4y + 10)$

B1

$y^2 + 35y + 300 = 60y + 150$

$y^2 - 25y + 150 = 0$

$y^2 - 10y - 15y + 150 = 0$

$y(y - 10) - 15(y - 10) = 0$

$(y - 10)(y - 15) = 0$

$y = 10$  or  $15$  yrs

M1

A1

both

ii) parents age

$4y + 10$       $y = 10$  or  $15$

$4(10) + 10$

$= 50$  yrs or

$= 4(15) + 10$

$= 70$  yrs

B1

B1

iii)  $y - 5$       $y = 10$  or  $15$

In 20 yrs  $y - 5 + 10 = y + 15$  yrs

$y + 15$       $y + 15$

25 yrs or 30 yrs

B1

B1

10

18.  $A = 6A$

Marks	f	x	$d = x - A$	fd	$d^2$	$fd^2$
45 - 49	3	47	-15	-45	225	675
50 - 54	9	52	-10	-90	100	900
55 - 59	13	57	-5	-65	25	325
60 - 64	15	62	0	0	0	0
65 - 69	5	67	5	25	25	125
70 - 74	4	72	10	40	100	400
75 - 79	1	77	15	15	225	225
	$\Sigma f = 50$			$\Sigma fd = -120$		$\Sigma fd^2 = 2650$

a) mean  $x = A + \frac{\sum fd}{\sum f}$   
 $62 + \frac{-120}{50}$   
 $= 62 - 2.4$   
 $= 59.6$

M1

A1

b)  $V = \left[ \frac{\sum fd^2}{\sum f} \right] - \left[ \frac{\sum fd}{\sum f} \right]^2$

$\frac{2650}{50} - \left( \frac{120}{50} \right)^2$

M1

$53 - 5.76$   
 $= 47.24$

M1

A1

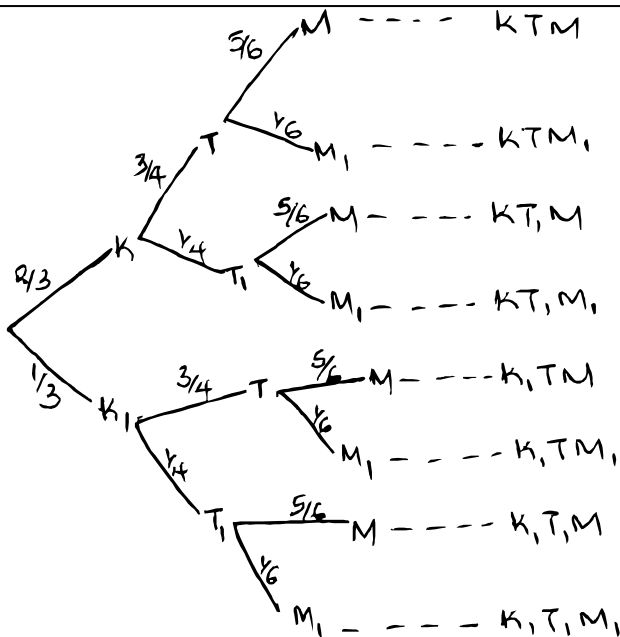
c) s.d =  $\sqrt{V}$   
 $= \sqrt{47.24}$   
 $= 6.873$

M1

A1

10

19.



i)  $P(K_1 T_1 M_1) = \frac{1}{3} \times \frac{1}{4} \times \frac{1}{6}$   
 $\frac{1}{72}$

M1

A1

ii)  $P(KTM)$  or  $P(KTM_1)$  or  $P(KT_1M)$  or  $P(K_1TM)$   
 $(\frac{2}{3} \times \frac{3}{4} \times \frac{5}{6})$  or  $(\frac{2}{3} \times \frac{3}{4} \times \frac{1}{6})$  or  $(\frac{2}{3} \times \frac{1}{4} \times \frac{5}{6})$

M1

or  $(\frac{1}{3} \times \frac{3}{4} \times \frac{5}{6})$

$\frac{30}{72} + \frac{6}{72} + \frac{10}{72} + \frac{15}{72}$   
 $\frac{61}{72}$

M1

A1

iii)  $P(KT_1M_1)$  or  $P(K_1TM_1)$  or  $P(K_1T_1M)$

$(\frac{2}{3} \times \frac{1}{4} \times \frac{1}{6}) + (\frac{1}{3} \times \frac{3}{4} \times \frac{1}{6}) + (\frac{1}{3} \times \frac{1}{4} \times \frac{5}{6})$

M1

$\frac{2}{72} + \frac{3}{72} + \frac{5}{72} = \frac{10}{72}$

A1

10

<p>20. a) <math>S = t^3 - 6t^2 + 2t + 3</math>  <math>t = 3</math>  <math>S = (3)^3 - 6(3)^2 + 2(3) + 3</math>  <math>= -18\text{m}</math></p>	<p>M1 A1</p>
<p>b) <math>S = t^3 - 6t^2 + 2t + 3</math>  <math>V = \frac{ds}{dt} = 3t^2 - 12t + 2</math>  <math>t = 4</math>  <math>V = 3(4)^2 - 12(4) + 2</math>  <math>= 2\text{m/s}</math></p>	<p>M1  A1</p>
<p>c) At rest <math>v = 0</math>  <math>3t^2 - 12t + 2 = 0</math>  <math>t = \frac{12 \pm \sqrt{144 - 24}}{6}</math>  <math>= \frac{12 + 10.95}{6}</math>  <math>t = 3.825</math> or  <math>t = 0.175</math> sec</p>	<p>M1 M1  A1</p>
<p>d) Acceleration at <math>t = 4</math>  <math>v = 3t^2 - 12t + 2</math>  <math>\text{acc} = \frac{dv}{dt} = 6t - 12</math>  <math>= 6(4) - 12</math>  <math>= 12\text{m/s}^2</math></p>	<p>M1 M1 A1 10</p>
<p>21. a) <math>\theta = 40^\circ + 50^\circ = 90^\circ</math>  <math>l = \frac{90}{360} \times 2 \times \frac{22}{7} \times 6370</math>  <math>= 10,010\text{km}</math></p> <p>b) <math>2550 = 60 \times \cos 50^\circ</math>  <math>x = \frac{2550}{60 \cos 50}</math>  <math>x = 66.12</math>  C(50°N, 66.12°E)</p> <p>c) Total distance  <math>= 10010 + (2550 \times 1.854)</math>  <math>= 14737.7\text{km}</math>   Time = <math>\frac{14737.7}{1200}</math>  Time taken  1400 + 12hrs 17min + 45min  = 0302hrs on Tuesday</p>	<p>B1 M1 A1 M1 A1 B1  B1  M1  A1 10</p>

22. a) Length of line QS

$$\begin{aligned} & \sqrt{16^2 + 12^2} \\ & \sqrt{256 + 144} = \sqrt{400} \\ & = 20\text{cm} \end{aligned}$$

M1

A1

b) Height of pyramid

$$\begin{aligned} & = \sqrt{13^2 - (20/2)^2} \\ & = \sqrt{169 - 100} \\ & = \sqrt{69} \\ & = 8.3\text{cm 1d.p} \end{aligned}$$

M1

A1

c)  $\cos \theta = \frac{10}{13}$

$$\begin{aligned} \cos \theta & = 0.7692 \\ \theta & = \cos^{-1}(0.7692) \\ & = 39.72^\circ \end{aligned}$$

A1

d)  $h^2 = 13^2 - 6^2$   
 $= 169 - 36$   
 $= 133$

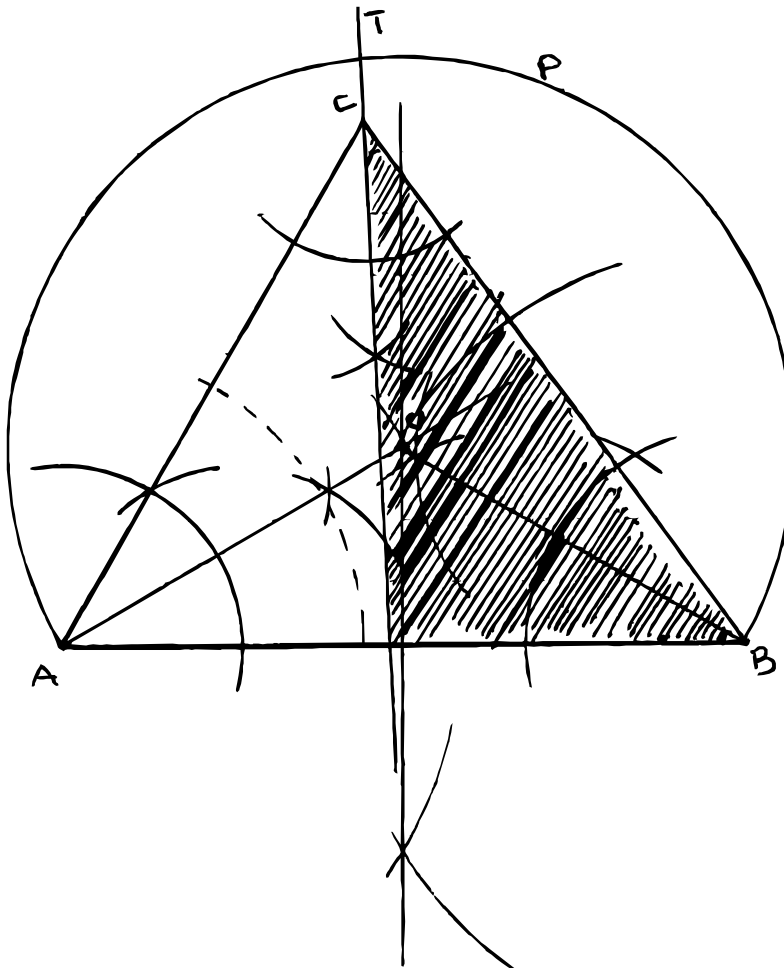
M1

$$\begin{aligned} h & = \sqrt{133} \\ & = 11.53\text{cm} \end{aligned}$$

A1

10

23.



- a) B1 ✓ construction of  $60^\circ$   
 B1 ✓  $\Delta$  completed
- b) B1 ✓ construction of  $30^\circ$  at A and B  
 B1 ✓ location of centre O  
 B1 ✓ arc APB (labelled)
- c) B1 ✓ arc 4cm from A dotted  
 B1 ✓ bisection of  $\angle ACB$   
 B1 ✓ identification and labelling of locus of T  
 B2 ✓ shading on the right of T



24. a) $\angle BRS = 45^\circ$ Reason alternate angle segment	B1 B1	accept any valid reason
b) $\angle BSU = 45^\circ$ Reason: angle sum of a triangle	B1 B1	
c) $\angle STR = 30^\circ$	B1 B1	
d) $\angle BAR = 80^\circ$ Reason: angles on a straight line add upto $180^\circ$	B1 B1	
e) $\angle ARB = 120^\circ$ Reason: cyclic quadrilateral	B1 B1	
	10	

