



SYDNEY BOYS HIGH SCHOOL
MOORE PARK, SURRY HILLS

Year 10

Yearly Examination 2010

Advanced Mathematics

General Instructions

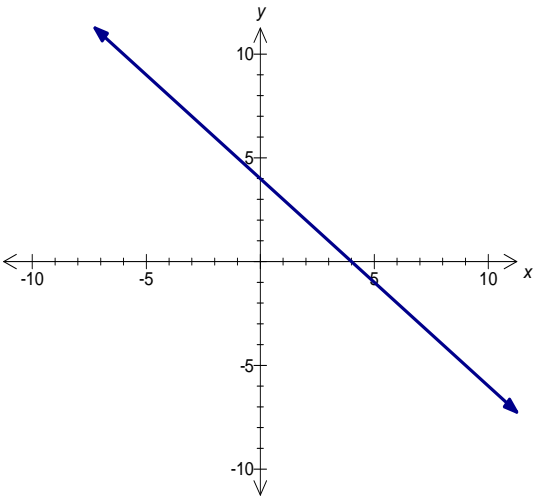
- Working time – 120 minutes
- Write using black or blue pen.
- Approved calculators may be used.
- All necessary working **MUST** be shown in every question if full marks are to be awarded.
- Marks may not be awarded for untidy or badly arranged work.
- If more space is required, clearly write the number of the **QUESTION** on one of the back pages and answer it there. Indicate that you have done so.
- All answers must be given in exact simplified form unless otherwise indicated.
- Clearly indicate your class by placing an X, next to your class

Examiner: *B. Kilmore*

NAME:

Class	Teacher	
10 A	Mr Fuller	
10 B	Ms Nesbitt	
10 C	Ms Ward	
10 D	Ms Roessler	
10 E	Mr McQuillan	
10 F	Mr Boros	
10 G	Mr Hespe	

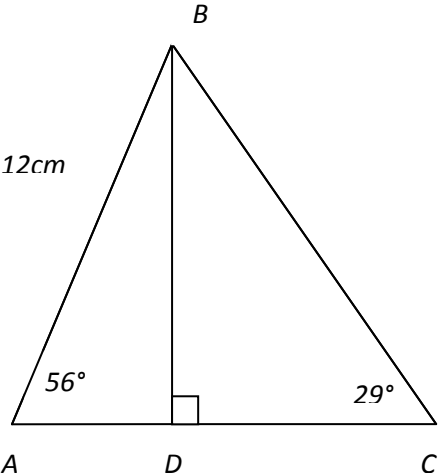
Question	Mark
1	/20
2	/20
3	/15
4	/20
5	/20
6	/15
7	/16
Total	/126

Question One (20 marks)		Answers	Marks
a	Write 23570000 in scientific notation.		1
b	Write the equation of the line shown below. 		2
c	Write with a positive index: $\left(\frac{a}{b}\right)^{-2}$		1
d	Write with a rational denominator in simplest form: $\frac{4}{3\sqrt{2}}$		1
e	Calculate the following, giving your answer correct to 2 decimal places. $\frac{4^3 - 5.14}{2 + \sqrt{65 - 3.2^2}}$		1
f	Given that $f(x) = x^2 - 3$, find the value of $f(-4)$		1
g	Write the equation of a circle with centre the origin and a radius of 6 units.		1
h	Multiple Choice: A distribution of 10 scores has a mean of 75. If the highest score is increased by 5, the new mean will be: A. 77.5 B. 80 C. 75.5 D. cannot be determined		1

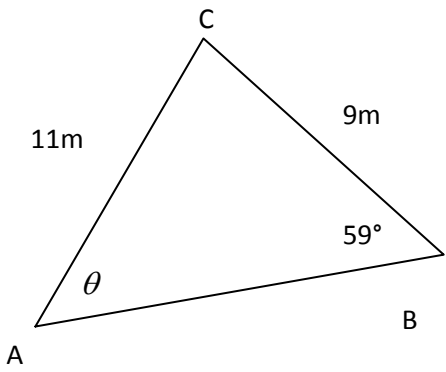
	Question One (continued)	Answers	Marks
i	Solve : $3 - 2x \leq 7$		2
j	Find the least value of $3 + (x - 1)^2$		1
k	Kelly runs the 14km City to Surf Race in 2 hours and 15 minutes. What is her speed in metres/second? Give your answer correct to two decimal places.		2
l	Sketch the region given by $x^2 + y^2 < 9$		1
m	Simplify $3\sqrt{54} + \sqrt{24}$		1
n	Expand and simplify: $(x - 7)^2$		1
o	Given that $\sin \theta = 0.819$, find θ to the nearest degree if θ is an obtuse angle.		1
p	A letter is chosen at random from the word PARRAMATTA i. What is the probability that it is a T? ii. What is the probability that it is not a vowel?		2

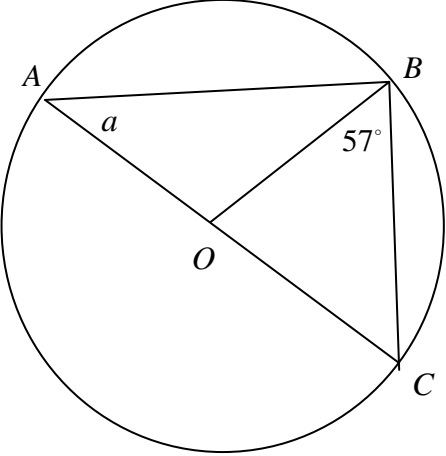
Question Two (20 Marks)	Answers	Marks
<p>a These are the marks achieved by two students in five revision tests</p> <p>Hung: 39, 45, 21, 38, 27</p> <p>Deng: 25, 44, 47, 19, 29</p> <p>i. Use your calculator to work out the mean and standard deviation for each student.</p> <p>ii. Whose results are the most consistent? Why?</p>		3
<p>b Factorise: $ef - 2f - 2e + f^2$</p>		2
<p>c Solve the following simultaneous equations:</p> <p>$2x + y = 4$</p> <p>$5x - 2y = 19$</p>		2

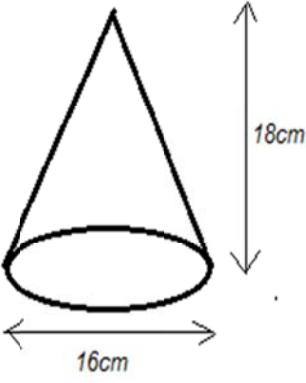
	Question Two (continued)	Answers	Marks
d	<p>For which values of x will the following functions be undefined?</p> <p>i. $g(x) = \frac{3x+7}{x-2}$</p> <p>ii. $y = \sqrt{x^2 - 9}$</p>		3
e	<p>Solve the following equations:</p> <p>i. $3x^2 - 48 = 0$</p> <p>ii. $2x^2 - 7x = 4$</p>		4
f	<p>Solve by using the quadratic formula. Leave your answer in simplified surd form.</p> <p>$x^2 - 8x - 3 = 0$</p>		2
g	<p>Find the exact value of $\frac{\sin 60^\circ}{\cos 60^\circ}$</p>		1

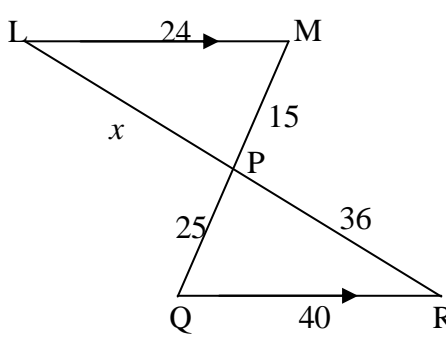
	Question Two (continued)	Answers	Marks
h	<p>Find the length of DC correct to 2 decimal places:</p>  <p>The diagram shows a triangle ABC with a perpendicular line segment BD from vertex B to the base AC. Side AB is labeled 12 cm. Angle A is 56° and angle C is 29°. Point D is on the base AC such that BD is perpendicular to AC.</p>		3

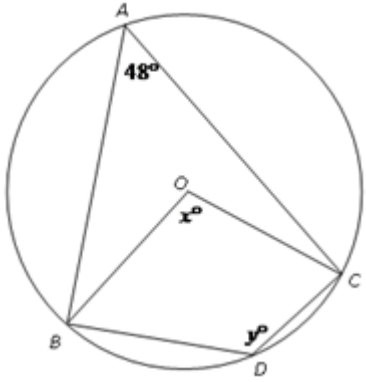
Question Three (15 Marks)	Answers	Marks
<p>a Shade the region on the number plane where $x + y \leq 4$ and $2y > 3x + 6$</p>		3
<p>b Find the value of m such that $\frac{1 - 2\sqrt{2}}{\sqrt{2} - 1} = m - \sqrt{2}$</p>		2
<p>c Draw a sketch of the following functions:</p> <p>i. $y = \frac{-1}{x}$</p> <p>(Indicate 2 points)</p>		6

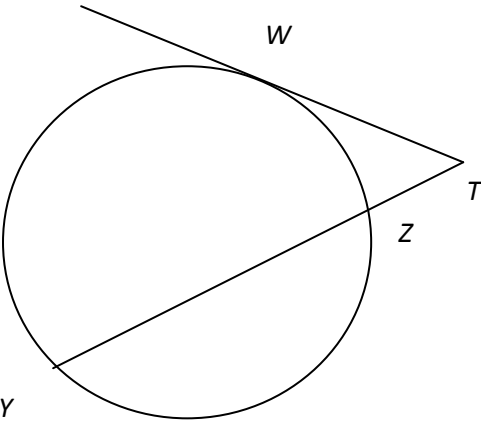
	Question Three (continued)	Answers	Marks
	<p>ii. $y = 2^x$</p> <p>(Show the y-intercept as well as one other point)</p> <p>iii. $y = (x - 4)(x - 1)(x + 5)$</p> <p>(Indicate the intercepts)</p>		
d	<p>Find θ, correct to the nearest minute, in the triangle ABC drawn below.</p>  <p>The diagram shows a triangle with vertices A, B, and C. Vertex C is at the top. Side AC is labeled 11m. Side BC is labeled 9m. The angle at vertex B is labeled 59°. The angle at vertex A is labeled θ.</p>		2

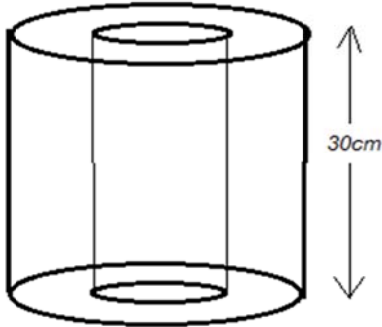
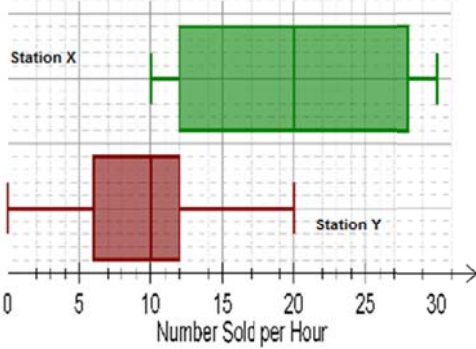
	Question Three (continued)	Answers	Marks
e	<p>Find the value of the angle a, giving reasons in full. (The centre of the circle is labelled 'O'.)</p>  <p>The diagram shows a circle with center O. Points A, B, and C are on the circumference. Lines OA, OB, and OC are drawn. Angle ABC is 57°. Angle BAC is labeled as a.</p>		2

Question Four (20 Marks)	Answers	Marks
<p>a For the parabola: $y = x^2 + 2x - 8$</p> <p>find</p> <ol style="list-style-type: none"> i. The x-intercept ii. The y-intercept iii. The vertex iv. Hence, sketch the graph 		4
<p>b Find the volume of this cone:</p> <div style="text-align: center;">  <p>The diagram shows a cone with a vertical height of 18 cm, indicated by a double-headed arrow on the right. The diameter of the circular base is 16 cm, indicated by a double-headed arrow at the bottom.</p> </div>		2

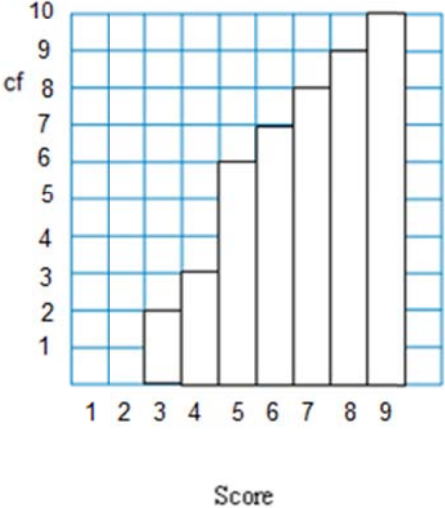
	Question Four (continued)	Answers	Marks
c	<p>The materials to make 25kg of an alloy of copper and zinc cost \$62. If the copper costs \$3.20/kg and zinc costs \$1.40/kg, find the composition of the alloy.</p>		3
d	<p>Sketch this curve by first completing the square on x :</p> $x^2 - 6x + y^2 = 7$		2
e	<p>i. Prove that $\triangle LMP \parallel \triangle PQR$</p>  <p>ii. Hence write an equation and solve it to find the value of x.</p>		3

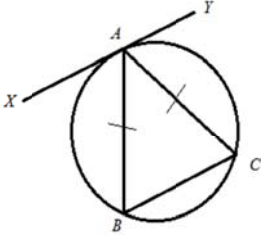
	Question Four (continued)	Answers	Marks
f	<p>In the diagram below $\angle BOC = x^\circ$, $\angle BDC = y^\circ$ and $\angle BAC = 48^\circ$. O is the centre of the circle. Find the values of x° and y° giving reasons in full.</p> 		3
g	<p>Fully factorise, if $(x-1)$ is one of the factors of $x^3 - 13x + 12 = 0$</p>		3

Question Five (20 Marks)	Answers	Marks
<p>a Solve the following simultaneous equations:</p> $y = x^2 - 5x + 8$ $y = 2x - 4$		3
<p>b Describe how the graph of $y = -(x - 2)^2 + 1$ differs from the graph of $y = x^2$</p>		3
<p>c The chord of a circle to an external point T cuts the circumference at Y and Z. A tangent from T meets the circumference at W.</p> <p>Given that $TZ = 40\text{cm}$, $ZY = 50\text{cm}$, calculate the length of TW. Give reasons for your answer.</p> 		2

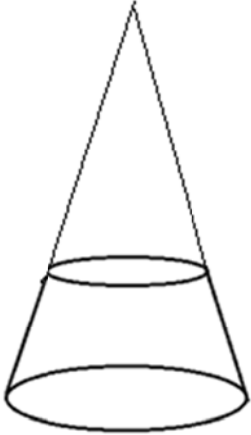
Question Five (continued)	Answers	Marks
<p>d Find the surface area of this object correct to the nearest cm^2 if it is to be coated both inside and out with a rust protector.</p> <p>The radius of the small cylinder is 5cm and the radius of the large cylinder is 15cm.</p> 		4
<p>e This pair of box and whisker plots show the number of copies of the Australian newspaper sold per hour during one week at two railway stations X and Y.</p>  <ol style="list-style-type: none"> i. Find the range and interquartile range of the sales of newspapers at Station X. ii. Find the median number of papers sold at Station Y per hour? 		3

	Question Five (continued)	Answers	Marks
f	AB is an interval with A(0,2) and B(4,0) i. Find the midpoint of AB ii. Find the gradient of the perpendicular bisector of AB iii. Hence, or otherwise, find the equation of the perpendicular bisector of AB		5

Question Six (15 Marks)	Answers	Marks																
<p>a Show that</p> $\frac{1}{(x-y)(x-z)} + \frac{1}{(y-z)(y-x)} + \frac{1}{(z-x)(z-y)} = 0$		3																
<p>b Find the mode of this data:</p> <p style="text-align: center;">Cumulative Frequency Histogram</p>  <table border="1" style="margin-left: auto; margin-right: auto;"> <caption>Data from Cumulative Frequency Histogram</caption> <thead> <tr> <th>Score</th> <th>Cumulative Frequency (cf)</th> </tr> </thead> <tbody> <tr><td>3</td><td>2</td></tr> <tr><td>4</td><td>3</td></tr> <tr><td>5</td><td>6</td></tr> <tr><td>6</td><td>7</td></tr> <tr><td>7</td><td>8</td></tr> <tr><td>8</td><td>9</td></tr> <tr><td>9</td><td>10</td></tr> </tbody> </table>	Score	Cumulative Frequency (cf)	3	2	4	3	5	6	6	7	7	8	8	9	9	10		1
Score	Cumulative Frequency (cf)																	
3	2																	
4	3																	
5	6																	
6	7																	
7	8																	
8	9																	
9	10																	
<p>c Use the remainder theorem to find the remainder for the following division: $(2x^3 + 7x - 13) \div (x - 2)$</p>		1																

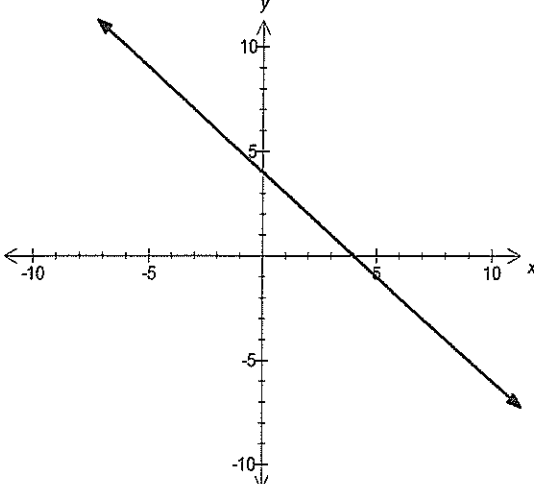
	Question Six (continued)	Answers	Marks
d	<p>Given: $AB = AC$ and XAY is a tangent to the circle at A. Prove that $BC \parallel XY$.</p> 		3
e	<p>If θ is an acute angle and $\cos \theta = \frac{3}{7}$, Find $\sin \theta$. (Answer in simplest surd form.)</p>		3

	Question Six (continued)	Answers	Marks
f	<p>A farmer has a triangular field ABC which has side $a = 17km$, side $b = 13km$ and side $c = 11km$. Calculate the cost of fertilizer if the farmer needs to use 1 tonne of fertilizer for every square kilometre and fertilizer costs \$155.50 per tonne (or part thereof).</p>		4

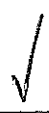
Question Seven (16 Marks)	Answers	Marks
<p>a Transpose the following formula to make b the subject.</p> $v = a \left(\frac{1}{b} - \frac{1}{c} \right)$		2
<p>b A lampshade is made by cutting off the top part of a cone. Find the area of material required to make this lampshade if the top opening has a radius of 7 cm and the bottom opening has a radius of 14cm and the lampshade is 24cm tall.</p>  <p style="text-align: right;">:hade</p>		4

	Question Seven (continued)	Answers	Marks
c	<p>The sum of the squares of two consecutive positive odd integers exceeds the product of the integers by 147. Find them.</p>		3
d	<p>A plane leaves town <i>A</i> and flies on a bearing of 120° for 600km to point <i>P</i>. It then changes direction to fly on a bearing of 230° until it reaches town <i>B</i>. The distance between town <i>A</i> and town <i>B</i> is 1100km.</p> <p>i. Draw a clear diagram showing the plane's trip showing all salient information.</p> <p>ii. Find the distance from town <i>P</i> to town <i>B</i></p> <p>Show all angle calculations on your diagram.</p>		4

	Question Seven (continued)	Answers	Marks
e	<p>By considering x^2 or otherwise, find the value of x as an integer:</p> $x = \sqrt{6 + \sqrt{6 + \sqrt{6 + \sqrt{6 + \dots}}}}$		3

Question One (20 marks)	Answers	Marks
a Write 23570000 in scientific notation.	2.357×10^7	1
b Write the equation of the line shown below. 	$y = -x + 4$ or $x + y - 4 = 0$	2
c Write with a positive index: $\left(\frac{a}{b}\right)^{-2}$	$\left(\frac{b}{a}\right)^2$	1
d Write with a rational denominator in simplest form: $\frac{4}{3\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{4\sqrt{2}}{3 \times 2} = \frac{2\sqrt{2}}{3}$	$\frac{2\sqrt{2}}{3}$	1
e Calculate the following, giving your answer correct to 2 decimal places. $\frac{4^3 - 5.14}{2 + \sqrt{65} - 3.2^2}$	6.26	1
f Given that $f(x) = x^2 - 3$, find the value of $f(-4)$	$f(-4) = (-4)^2 - 3$ $= 16 - 3$ $= 13$	1
g Write the equation of a circle with centre the origin and a radius of 6 units.	$x^2 + y^2 = 36$	1
h Multiple Choice: A distribution of 10 scores has a mean of 75. If the highest score is increased by 5, the new mean will be: A. 77.5 B. 80 C. 75.5 D. cannot be determined	$\frac{10 \times 75 + 5}{10} = 75.5$ C.	1

	Question One (continued)	Answers	Marks
i	Solve: $3 - 2x \leq 7$	$-2x \leq 4$ $x \geq -2$	2
j	Find the least value of $3 + (x-1)^2$	When $x=1$, value is 3	1
k	Kelly runs the 14km City to Surf Race in 2 hours and 15 minutes. What is her speed in metres/second? Give your answer correct to two decimal places.	$\frac{14000 \text{ m}}{2.25 \times 3600 \text{ s}} \approx 1.73 \text{ m/s}$	2
l	Sketch the region given by $x^2 + y^2 < 9$		1
m	Simplify $3\sqrt{54} + \sqrt{24} = 3\sqrt{9 \times 6} + \sqrt{4 \times 6}$	$= 9\sqrt{6} + 2\sqrt{6}$ $= 11\sqrt{6}$	1
n	Expand and simplify: $(x-7)^2$	$x^2 - 7x - 7x + 49 = x^2 - 14x + 49$	1
o	Given that $\sin \theta = 0.819$, find θ to the nearest degree if θ is an obtuse angle.	$180^\circ - 54.98^\circ \approx 125^\circ$	1
	$\sin^{-1}(0.819) \doteq 54.98^\circ$		
p	A letter is chosen at random from the word PARRAMATTA i. What is the probability that it is a T? ii. What is the probability that it is not a vowel?	(i) $\frac{2}{10} = \frac{1}{5}$ (ii) $\frac{6}{10} = \frac{3}{5}$ or $1 - \frac{4}{10} = \frac{3}{5}$	2



Question Two (20 Marks)	Answers	Marks
<p>a These are the marks achieved by two students in five revision tests</p> <p>Hung: 39, 45, 21, 38, 27</p> <p>Deng: 25, 44, 47, 19, 29</p> <p>i. Use your calculator to work out the mean and standard deviation for each student.</p> <p>ii. Whose results are the most consistent? Why?</p>	<p>Hung \bar{x} 34 SD 8.7 (1)</p> <p>Deng \bar{x} 32.8 SD 10.9 (1)</p> <p>smaller SD the more consistent Hung (1)</p>	<p>3</p>
<p>b Factorise: $ef - 2f - 2e + f^2$</p> <p>$ef + f^2 - 2f - 2e$</p> <p>$f(e+f) - 2(e+f)$</p>	<p>$(e+f)(f-2)$ (2)</p>	<p>2</p>
<p>c Solve the following simultaneous equations:</p> <p>$2x + y = 4$ (i)</p> <p>$5x - 2y = 19$ (ii)</p> <p>so</p>	<p>(i) x2 $4x + 2y = 8$ +</p> <p>$5x - 2y = 19$</p> <hr/> <p>$9x = 27$</p> <p>$x = 3$</p> <p>$6 + y = 4$ $y = -2$</p>	<p>2</p>

3 (3, -2) (2)

	Question Two (continued)	Answers	Marks
d	For which values of x will the following functions be undefined? i. $g(x) = \frac{3x+7}{x-2}$ ii. $y = \sqrt{x^2-9}$	(i) $x \neq 2$ (ii) $-3 < x < 3$ (accept $x > -3, x < 3$)	³ (1) (2)
e	Solve the following equations: i. $3x^2 - 48 = 0$ ii. $2x^2 - 7x = 4$	$3x^2 - 48 = 0$ $\div 3 \quad x^2 - 16 = 0$ $(x-4)(x+4) = 0$ $x = \pm 4$ (2) $2x^2 - 7x - 4 = 0$ $(2x+1)(x-4) = 0$ $x = -\frac{1}{2}, x = 4$ (2)	4
f	Solve by using the quadratic formula. Leave your answer in simplified surd form. $x^2 - 8x - 3 = 0$ $a = 1$ $b = -8$ $c = -3$	$x = \frac{-8 \pm \sqrt{64 - 4 \times 1 \times -3}}{2}$ $= \frac{8 \pm \sqrt{76}}{2}$ $= \frac{8 \pm 2\sqrt{19}}{2}$ $= 4 \pm \sqrt{19}$ (2)	2
g	Find the exact value of $\frac{\sin 60^\circ}{\cos 60^\circ}$ or $(\tan 60^\circ = \sqrt{3})$	$\frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}} = \frac{\sqrt{3}}{2} \times \frac{2}{1} = \sqrt{3}$	¹ (1)

9 (7) h

($\tan 60^\circ = \sqrt{3}$)
 $\frac{2}{4}$

h

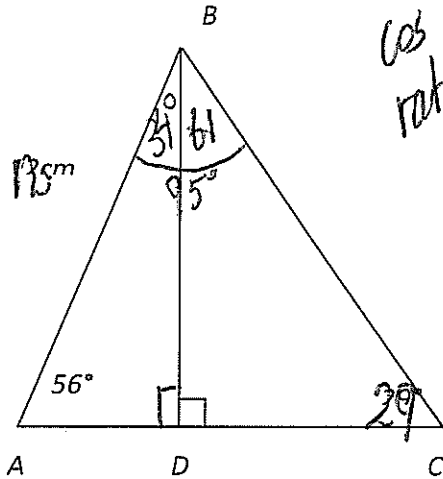
Question Two (continued)

Answers

Marks

i

Find the length of DC correct to 2 decimal places:



cos ratio

In $\triangle ADB$
 $\cos 56^\circ = \frac{AD}{12}$
 $AD = 12 \cos 56$

In $\triangle ABC$,
 sine rule: $\frac{AC}{\sin 95^\circ} = \frac{12}{\sin 29^\circ}$

$$AC = \frac{12 \sin 95}{\sin 29}$$

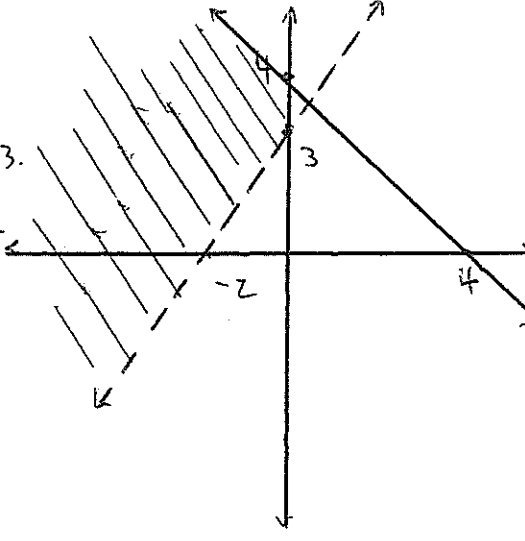
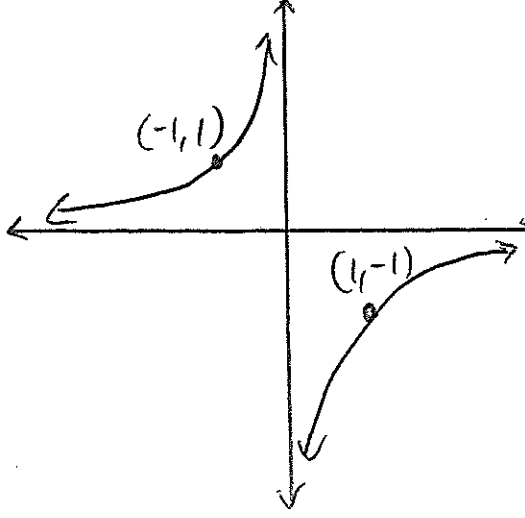
since $AD + DC = AC$

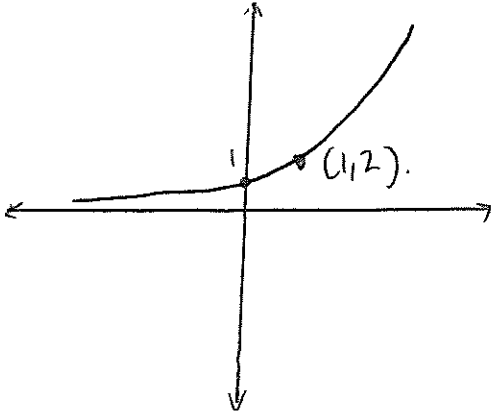
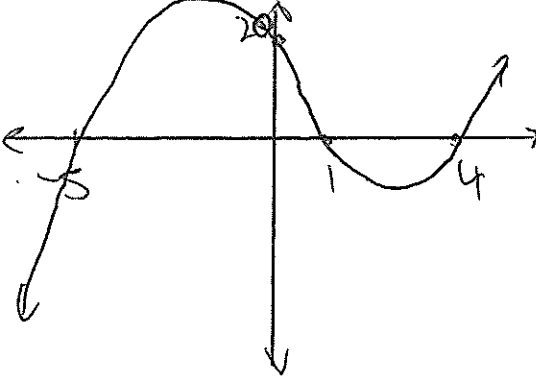
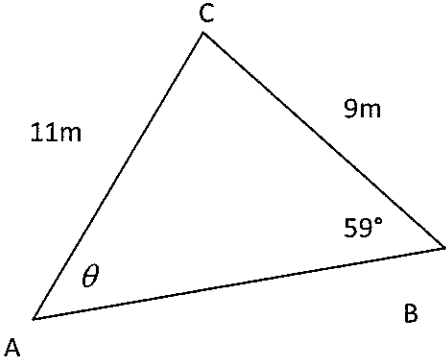
$$AC - AD = DC$$

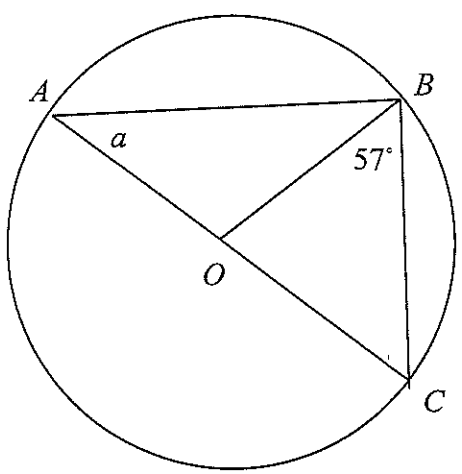
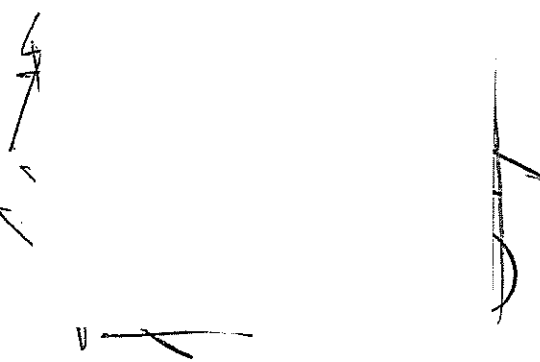
$$\frac{12 \sin 95}{\sin 29} - 12 \cos 56 = DC$$

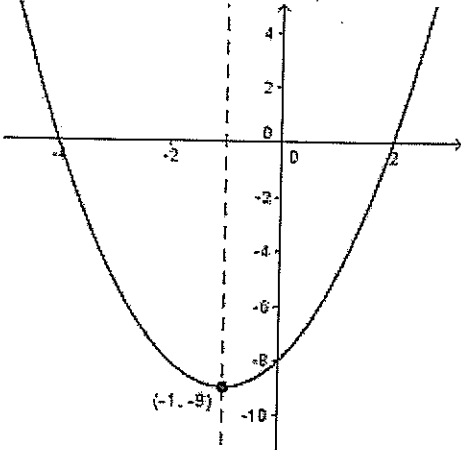
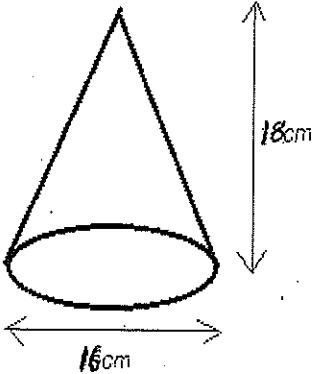
$$DC \hat{=} 17.95 \text{ cm} \quad (3)$$

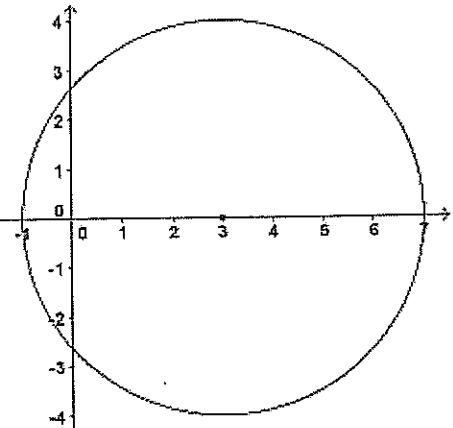
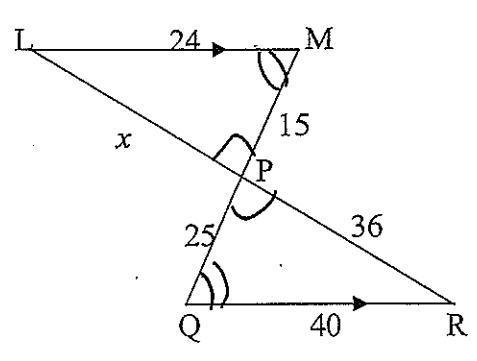
3

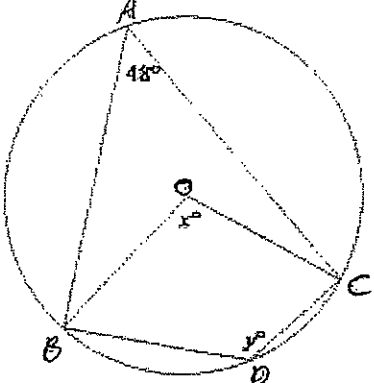
Question Three (15 Marks)	Answers	Marks
<p>a Shade the region on the number plane where $x + y \leq 4$ and $2y > 3x + 6$</p> <p>$y > \frac{3}{2}x + 3$</p> <p>$y \leq -x + 4$</p>		3
<p>b Find the value of m such that $\frac{1-2\sqrt{2}}{\sqrt{2}-1} = m - \sqrt{2}$</p>	<p>$m = -3$</p>	2
<p>c Draw a sketch of the following functions:</p> <p>i. $y = \frac{-1}{x}$</p> <p>(Indicate 2 points)</p>		4

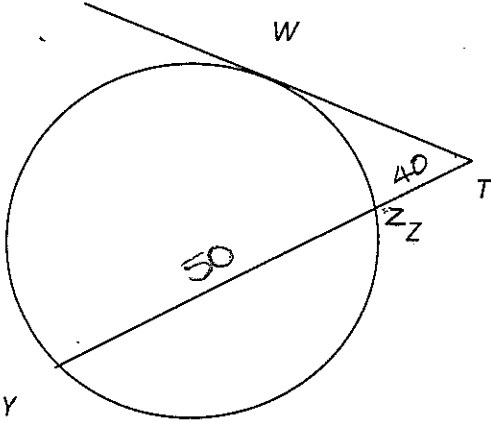
Question Three (continued)	Answers	Marks
<p>ii. $y = 2^x$</p> <p>(Show the y-intercept as well as one other point)</p>		<p>2</p>
<p>iii. $y = (x-4)(x-1)(x+5)$</p> <p>(Indicate the intercepts)</p>		<p>2</p>
<p>d Find θ, correct to the nearest minute, in the triangle ABC drawn below.</p> 	$\frac{\sin \theta}{9} = \frac{\sin 59}{11}$ $\sin \theta = \frac{9 \sin 59}{11}$ $\theta = 44^{\circ} 32'$	<p>2</p>

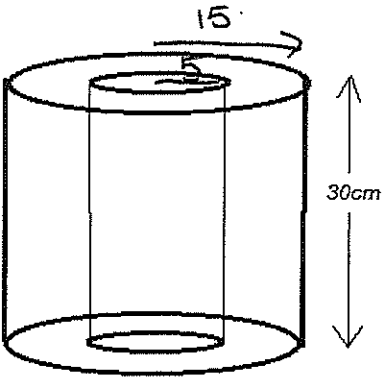
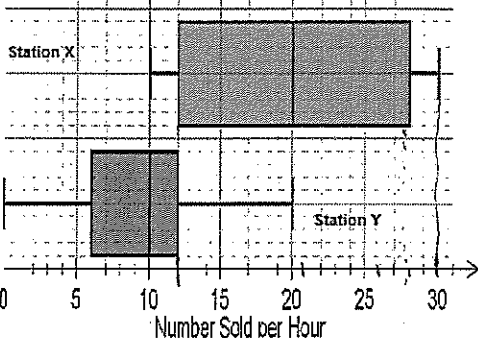
	Question Three (continued)	Answers	Marks
e	<p>Find the value of the angle a, giving reasons in full. (The centre of the circle is labelled 'O'.)</p> 	 <p> $\angle ABC = 90^\circ$ (\angle in a semi-circle). $\angle ABO = 33^\circ$ (complementary \angles) $\angle BAO = 33^\circ$ (base \angles isos Δ). $\therefore a = 33^\circ$. </p>	2

Question Four (20 Marks)	Answers	Marks
<p>a For the parabola: $y = x^2 + 2x - 8$</p> <p>find</p> <ol style="list-style-type: none"> The x-intercept The y-intercept The vertex Hence, sketch the graph 	<p>$x = -4, 2$</p> <p>$y = -8$</p> <p>$(-1, -9)$</p> 	4
<p>b Find the volume of this cone:</p> 	<p>$V = \frac{1}{3} \pi r^2 h$</p> <p>$= \frac{1}{3} \times \pi \times 8^2 \times 18$</p> <p>$\therefore 1206.37 \text{ cm}^3$</p> <p>or</p> <p>$384 \pi \text{ cm}^3$</p>	2

	Question Four (continued)	Answers	Marks
c	<p>The materials to make 25kg of an alloy of copper and zinc cost \$62. If the copper costs \$3.20/kg and zinc costs \$1.40/kg, find the composition of the alloy.</p>	$x \text{ copper} + y \text{ zinc} = 25$ $3.20x + 1.40y = 62$ $x + y = 25 \quad \text{--- (1)}$ $320x + 140y = 6200 \quad \text{(2)}$ <p>15kg copper 10kg zinc</p>	3
d	<p>Sketch this curve by first completing the square on x:</p> $x^2 - 6x + y^2 = 7$ $(x - 3)^2 + y^2 = 4^2$ <p>centre (3, 0) radius 4</p>		2
e	<p>i. Prove that $\triangle LMP \parallel \triangle PQR$</p>  <p>ii. Hence write an equation and solve it to find the value of x.</p>	<p>(i) Equiangular</p> <p>(ii) $\frac{24}{40} = \frac{x}{36}$</p> $x = 21.6$	3

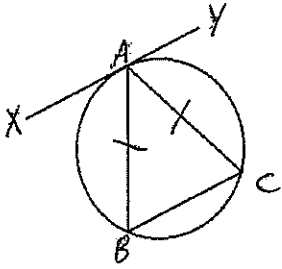
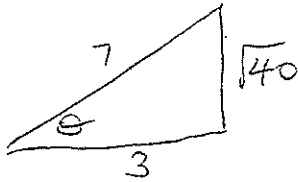
	Question Four (continued)	Answers	Marks
f	<p>In the diagram below $\angle BOC = x^\circ$, $\angle BDC = y^\circ$ and $\angle BAC = 48^\circ$. O is the centre of the circle. Find the values of x° and y° giving reasons in full.</p> 	$x = 2 \times 48 = 96^\circ$ <p>(angle at the centre is twice the angle at circumference)</p> $y = 180 - 48 = 132^\circ$ <p>(supplementary angles cyclic quadrilateral)</p>	3
g	<p>Fully factorise, if $(x-1)$ is one of the factors of $x^3 - 13x + 12 = 0$.</p>	$x-1 \overline{) \begin{array}{r} x^3 + x^2 - 12 \\ x^3 - 0x^2 - 13x + 12 \\ \hline x^2 + x - 12 \end{array}}$ $(x-1)(x-3)(x+4)$	3

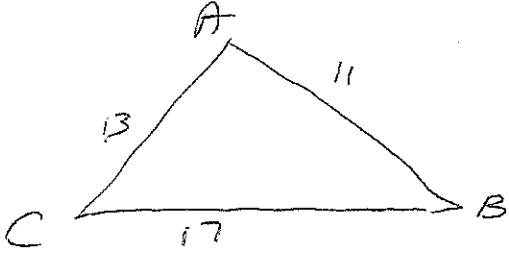
Question Five (20 Marks)	Answers	Marks
<p>a Solve the following simultaneous equations:</p> $y = x^2 - 5x + 8$ $y = 2x - 4$ $2x - 4 = x^2 - 5x + 8$ $x^2 - 7x + 12 = 0 \quad (1)$ $(x - 3)(x - 4) = 0$	$x = 3, \text{ or } 4 \quad (2)$ $y = 2 \text{ or } 4.$ <p>@for no 'y' values</p>	3
<p>b Describe how the graph of $y = -(x - 2)^2 + 1$ differs from the graph of $y = x^2$</p>	<p>MOVED UP 1 UNIT (1)³</p> <p>MOVED RIGHT 2 UNITS (1)</p> <p>REFLECTED in x axis (1)</p>	
<p>c The chord of a circle to an external point T cuts the circumference at Y and Z. A tangent from T meets the circumference at W.</p> <p>Given that $TZ = 40\text{cm}$, $ZY = 50\text{cm}$, calculate the length of TW.</p> <p>Give reasons for your answer.</p> 	$TW^2 = YT \cdot x ZT \text{ (Tangent Secant Thm)} \quad (1)$ $= 90 \times 40$ $= 3600$ $TW = \sqrt{3600}$ $TW = 60 \quad (1)$	2

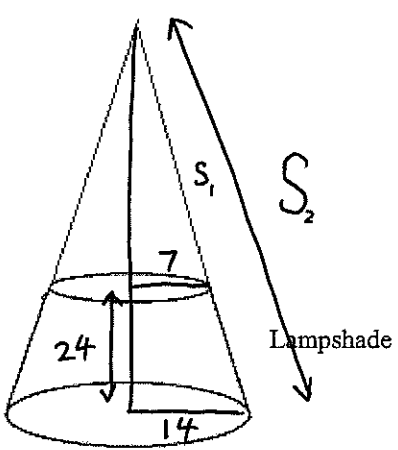
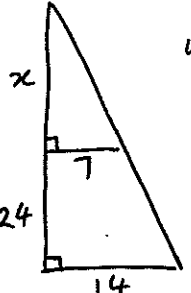
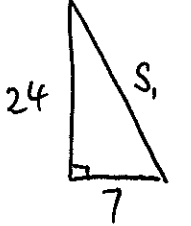
	Question Five (continued)	Answers	Marks
d	<p>Find the surface area of this object correct to the nearest cm^2 if it is to be coated both inside and out with a rust protector.</p> <p>The radius of the small cylinder is 5cm and the radius of the large cylinder is 15cm.</p> 	<p>INSIDE = $2\pi r \times h$ $= 2\pi \times 5 \times 30$ $= 300\pi$</p> <p>OUTSIDE = $2\pi r \times h$ $= 2\pi \times 15 \times 30$ $= 900\pi$</p> <p>TOP = $\pi(15)^2 - \pi(5)^2$ $= 200\pi$</p> <p>BOTTOM = 200π</p> <p>TOTAL SA = $300\pi + 900\pi + 200\pi + 200\pi$ $= 1600\pi$ $= 5026.55$</p> <p>SA = <u>5027</u> (nearest cm^2) ①</p>	4
e	<p>This pair of box and whisker plots show the number of copies of the Australian newspaper sold per hour during one week at two railway stations X and Y.</p>  <p>i. Find the range and interquartile range of the sales of newspapers at Station X.</p> <p>ii. Find the median number of papers sold at Station Y per hour?</p>	<p>i) Range = $30 - 10 = 20$ ①</p> <p>Int Q Range = $28 - 12 = 16$ ①</p> <p>14, 15, 16, due to not being able to see.</p> <p>ii) 10 ①</p>	3

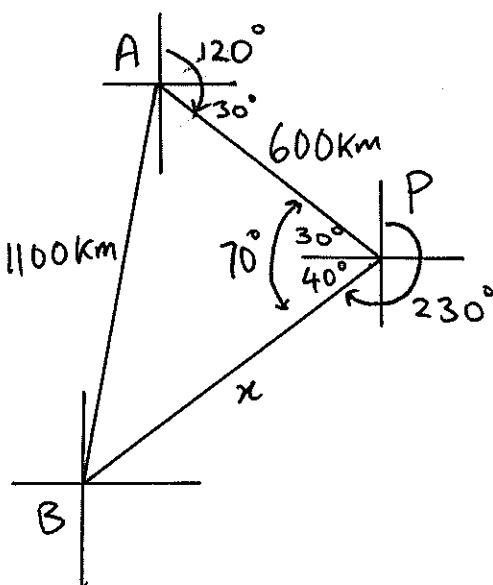
	Question Five (continued)	Answers	Marks
h	AB is an interval with A(0,2) and B(4,0)		5
	i. Find the midpoint of AB	$\left(\frac{0+4}{2}, \frac{2+0}{2}\right) = (2, 1)$ (1)	
	ii. Find the gradient of the perpendicular bisector of AB	$m_{AB} = \frac{2-0}{0-4} = -\frac{1}{2}$ Grad. perp bisector = 2 (2)	
	iii. Hence, or otherwise, find the equation of the perpendicular bisector of AB	$y - y_1 = m(x - x_1)$ $y - 1 = 2(x - 2)$ $y = 2x - 4 + 1$ $y = 2x - 3$ (2) <u>$2x - y - 3 = 0$</u>	

Question Six (15 Marks)		Answers	Marks																
a	Show that $\frac{1}{(x-y)(x-z)} + \frac{1}{(y-z)(y-x)} + \frac{1}{(z-x)(z-y)} = 0$	$\text{LHS} = \frac{y-z - (x-z) + x-y}{(x-y)(x-z)(y-z)}$ $= 0$	3																
b	Find the mode of this data: Cumulative Frequency Histogram <table border="1"> <caption>Data from Cumulative Frequency Histogram</caption> <thead> <tr> <th>Score</th> <th>Cumulative Frequency</th> </tr> </thead> <tbody> <tr><td>1</td><td>2</td></tr> <tr><td>2</td><td>3</td></tr> <tr><td>3</td><td>5</td></tr> <tr><td>4</td><td>7</td></tr> <tr><td>5</td><td>8</td></tr> <tr><td>6</td><td>9</td></tr> <tr><td>7</td><td>10</td></tr> </tbody> </table>	Score	Cumulative Frequency	1	2	2	3	3	5	4	7	5	8	6	9	7	10	$\text{mode} = 5$	1
Score	Cumulative Frequency																		
1	2																		
2	3																		
3	5																		
4	7																		
5	8																		
6	9																		
7	10																		
c	Use the remainder theorem to find the remainder for the following division: $(2x^3 + 7x - 13) \div (x - 2)$	$P(2) = 2(2)^3 + 7(2) - 13$ $= 17$	1																

	Question Six (continued)	Answers	Marks
d	<p>Given: $AB = AC$ and XAY is a tangent to the circle at A. Prove that $BC \parallel XY$.</p> 	<p>$\angle XAB = \angle ACB$ (ALT segment theorem)</p> <p>$\angle ACB = \angle ABC$ (base angles of isosceles $\triangle ABC$)</p> <p>$\therefore \angle XAB = \angle ABC$</p> <p>$\therefore XY \parallel BC$ (alternate \angles equal)</p>	3
e	<p>If θ is an acute angle and $\cos \theta = \frac{3}{7}$, Find $\sin \theta$. (Answer in simplest surd form.)</p>	 <p>$\sin \theta = \frac{\sqrt{40}}{7}$</p> <p>$= \frac{2\sqrt{10}}{7}$</p>	3

	Question Six (continued)	Answers	Marks
f	<p>A farmer has a triangular field ABC which has side $a = 17\text{km}$, side $b = 13\text{km}$ and side $c = 11\text{km}$. Calculate the cost of fertilizer if the farmer needs to use 1 tonne of fertilizer for every square kilometre and fertilizer costs \$155.50 per tonne (or part thereof).</p>	 $\cos B = \frac{13^2 + 11^2 - 17^2}{2 \times 13 \times 11}$ $\angle B = 49.88^\circ$ $A = \frac{1}{2} \times 17 \times 11 \times \sin B$ $= 71.5 \text{ km}^2$ <p>charged for 72 km²</p> $\text{Cost } 72 \times 155.5$ $= \$11196$	4

Question Seven (16 Marks)	Answers	Marks
<p>a Transpose the following formula to make b the subject.</p> $v = a \left(\frac{1}{b} - \frac{1}{c} \right)$	$v = a \left(\frac{1}{b} - \frac{1}{c} \right)$ $\frac{v}{a} = \frac{1}{b} - \frac{1}{c}$ $\frac{v}{a} + \frac{1}{c} = \frac{1}{b}$ $\frac{vc + a}{ac} = \frac{1}{b}$ $b = \frac{ac}{vc + a}$	2
<p>b A lampshade is made by cutting off the top part of a cone. Find the area of material required to make this lampshade if the top opening has a radius of 7 cm and the bottom opening has a radius of 14 cm and the lampshade is 24 cm tall.</p> 	<p>using similar triangles</p>  $\frac{x}{x+24} = \frac{7}{14}$ $\frac{x}{x+24} = \frac{1}{2}$ $2x = x + 24$ $\underline{x = 24}$  $S_1^2 = 24^2 + 7^2$ $S_1^2 = 625$ $\underline{S_1 = 25}$ $\underline{S_2 = 50}$ $\text{Area} = \pi R S_2 - \pi r S_1$ $= \pi(14)(50) - \pi(7)(25)$ $= 525\pi \text{ cm}^2$ $\approx 1649.34 \text{ cm}^2$	4

	Question Seven (continued)	Answers	Marks
c	<p>The sum of the squares of two consecutive positive odd integers exceeds the product of the integers by 147. Find them.</p>	<p>let x be a positive odd integer.</p> $x^2 + (x+2)^2 = x(x+2) + 147$ $x^2 + x^2 + 4x + 4 = x^2 + 2x + 147$ $x^2 + 2x - 143 = 0$ $(x+13)(x-11) = 0$ <p>$x = 11, -13$</p> <p>since x is a positive odd integer</p> <p>\therefore consecutive odd integers are 11 & 13.</p>	3
d	<p>A plane leaves town A and flies on a bearing of 120° for 600km to point P. It then changes direction to fly on a bearing of 230° until it reaches town B. The distance between town A and town B is 1100km.</p> <p>i. Draw a clear diagram showing the plane's trip showing all salient information.</p> <p>ii. Find the distance from town P to town B</p> <p>Show all angle calculations on your diagram.</p>	 $1100^2 = x^2 + 600^2 - 2(x)(600)\cos 70^\circ$ $x^2 - 1200\cos 70^\circ x - 850000 = 0$ $x = \frac{1200\cos 70^\circ \pm \sqrt{(-1200\cos 70^\circ)^2 - 4(1)(-850000)}}{2(1)}$ $x \approx 1149.73, -739.30$ <p>Distance from town P to town B is 1149.73 km.</p>	4

OR

use sine rule twice; Find size of $\angle ABP$.
Find value of x .

	Question Seven (continued)	Answers	Marks
e	<p>By considering x^2 or otherwise, find the value of x as an integer:</p> $x = \sqrt{6 + \sqrt{6 + \sqrt{6 + \sqrt{6 + \dots}}}}$	$x = \sqrt{6 + \sqrt{6 + \sqrt{6 + \sqrt{6 + \dots}}}} \quad \text{--- ①}$ $x^2 = 6 + \sqrt{6 + \sqrt{6 + \sqrt{6 + \dots}}} \quad \text{--- ②}$ $\text{②} - \text{①}$ $x^2 - x = 6$ $x^2 - x - 6 = 0$ $(x - 3)(x + 2) = 0$ $x = -2, \text{ ③}$ <p>x is clearly positive.</p> $\therefore x = 3$	3