

# Wallace High School

27/1/11

*Prelim Examination 2010/2011*

<p><b>MATHEMATICS</b> <b>National Qualifications - Intermediate 2</b> <b>Maths 1 and 2</b> <b>Paper 1 (non-calculator)</b></p>
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Time allowed - 45 minutes

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**Read carefully**

1. You may **NOT** use a calculator.
2. Full credit will be given only where the solution contains appropriate working.
3. Square-ruled paper is provided.

## FORMULAE LIST

The roots of  $ax^2 + bx + c = 0$  are  $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Sine rule:  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule:  $a^2 = b^2 + c^2 - 2bc \cos A$  or  $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle:  $\text{Area} = \frac{1}{2} ab \sin C$

Volume of a sphere:  $\text{Volume} = \frac{4}{3} \pi r^3$

Volume of a cone:  $\text{Volume} = \frac{1}{3} \pi r^2 h$

Volume of a cylinder:  $\text{Volume} = \pi r^2 h$

Standard deviation:  $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}} = \sqrt{\frac{\sum x^2 - (\sum x)^2 / n}{n - 1}}$ , where n is the sample size.

1. A line has equation  $2y + 6x = 9$ .

Find its gradient and  $y$ -intercept.

**3**

2. The number of people attending an emergency dental clinic over the course of 4 weeks was recorded.

12	14	13	14	17	18	20	13	16	13
12	15	16	20	14	19	16	15	17	17

(a) Show the above information in a dot plot.

**2**

(b) Comment on the shape of the distribution.

**1**

3. The String section of the Scottish National Orchestra has

26 violinists  
12 violists  
10 cellists  
7 double bass players.

If a player is chosen at random from the String section, what is the probability that it will be a cellist?

**2**

4. Multiply the brackets and simplify

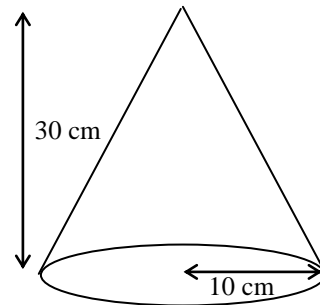
$$4x - (x - 4)(2x + 1)$$

**3**

5. Factorise  $a^2 - 64b^2$  2

6. The diagram shows a cone with radius 10 centimetres and height 30 centimetres.

Taking  $\pi = 3.14$ , calculate the volume of the cylinder.



3

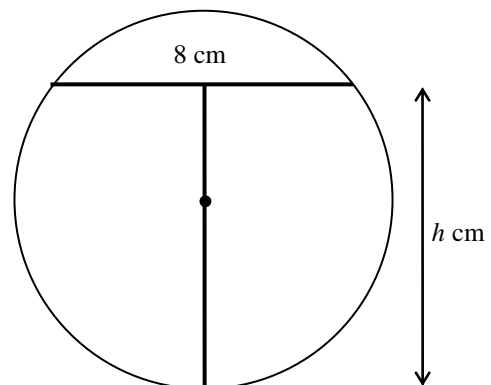
7. Solve, **algebraically**, the system of equations

$$\begin{aligned} 3x + 2y &= 13 \\ x &= y + 1 \end{aligned}$$

4

8. The diagram shows a circle, centre O, with a letter 'T' inside it. The width of the 'T' is 8 cm and the radius of the circle is 5 cm.

Calculate the height,  $h$  cm, of the 'T'.



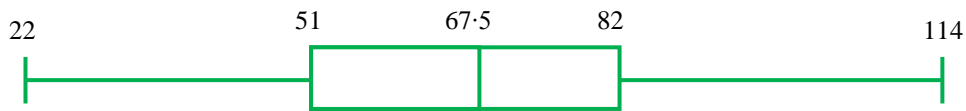
4

9. A group of S3 pupils produced the following set of Bleep Test results in PE before they started their Standard Grade course in August.

24, 30, 31, 36, 36, 42, 45, 50, 51, 55, 58, 62, 66, 72, 78, 82, 94, 96, 101, 115, 126

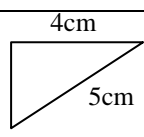
- (a) Write down the lower quartile, median and upper quartile of the data. **3**
- (b) Construct a box plot to illustrate the data. **2**

In December, the Bleep Test was repeated and this box plot drawn.

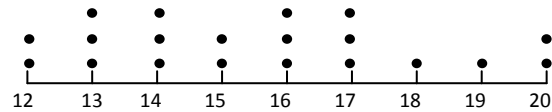


- (c) Compare the data in August with the data in December. **1**

*End of question paper*

Qu	Answer and Marks	Examples of Evidence
<b>1</b>	<b>ans : <math>m = -3</math>; (0, 4.5) 3 marks</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> rearranges equation to <math>y = mx + c</math></li> <li>•<sup>2</sup> states gradient</li> <li>•<sup>3</sup> states <math>y</math> – axis intercept</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>y = -3x + 4.5</math></li> <li>•<sup>2</sup> <math>m = -3</math></li> <li>•<sup>3</sup> (0, 4.5)</li> </ul>
<b>2a</b>	<b>ans : dot plot drawn 2 marks</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> suitable scale</li> <li>•<sup>2</sup> dots added</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> see end</li> <li>•<sup>2</sup> see end [allow two errors]</li> </ul>
<b>b</b>	<b>ans: uniform distribution 1 mark</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> correct description</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> uniform distribution</li> </ul>
<b>3</b>	<b>ans : 10/55 [or 2/11] 2 marks</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> correct numerator</li> <li>•<sup>2</sup> correct denominator</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> 10/..... [No need to simplify- do not penalize if simplified]</li> <li>•<sup>2</sup> ...../55</li> </ul>
<b>4</b>	<b>ans : <math>4 + 11x - 2x^2</math> 3 marks</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> multiplies brackets</li> <li>•<sup>2</sup> simplifies</li> <li>•<sup>3</sup> answer</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>4x - [2x^2 - 8x + x - 4]</math></li> <li>•<sup>2</sup> <math>4x - 2x^2 + 7x + 4</math></li> <li>•<sup>3</sup> <math>4 + 11x - 2x^2</math></li> </ul>
<b>5</b>	<b>ans : <math>(a - 8b)(a + 8b)</math> 2 marks</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> recognises diff. of two squares</li> <li>•<sup>2</sup> factorises correctly</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> evidence</li> <li>•<sup>2</sup> <math>(a - 8b)(a + 8b)</math></li> </ul>
<b>6</b>	<b>ans : <math>3\ 140\text{ cm}^3</math> 3 marks</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> subs values into formula</li> <li>•<sup>2</sup> attempts to simplify before calculation</li> <li>•<sup>3</sup> answer</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>V = \frac{1}{3} \times 3.14 \times 10^2 \times 30</math></li> <li>•<sup>2</sup> evidence</li> <li>•<sup>3</sup> <math>3\ 140\text{ cm}^3</math></li> </ul>
<b>7</b>	<b>ans : <math>x = 3</math>; <math>y = 2</math> 4 marks</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> subs for <math>x</math></li> <li>•<sup>2</sup> solves for <math>y</math></li> <li>•<sup>3</sup> knows to sub</li> <li>•<sup>4</sup> solves for <math>x</math></li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>3(y + 1) + 2y = 13</math></li> <li>•<sup>2</sup> <math>y = 2</math></li> <li>•<sup>3</sup> subs for <math>y</math></li> <li>•<sup>4</sup> <math>x = 3</math></li> </ul>
<b>8</b>	<b>ans : 8 cm 4 marks</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> assembles facts in RAT</li> <li>•<sup>2</sup> knows to use Pythagoras</li> <li>•<sup>3</sup> finds missing side</li> <li>•<sup>4</sup> answer</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> </li> <li>•<sup>2</sup> <math>\sqrt{(5^2 - 4^2)}</math></li> <li>•<sup>3</sup> 3 cm</li> <li>•<sup>4</sup> <math>3 + 5 = 8\text{ cm}</math></li> </ul>

Qu	Answer and Marks	Examples of Evidence
<b>9a</b>	<b>ans : 39; 58; 88</b> <b>3 marks</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> identifies lower quartile</li> <li>•<sup>2</sup> identifies median</li> <li>•<sup>3</sup> identifies upper quartile</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>Q_1 = 39</math></li> <li>•<sup>2</sup> <math>Q_2 = 58</math></li> <li>•<sup>3</sup> <math>Q_3 = 88</math></li> </ul>
<b>b</b>	<b>ans: box plot drawn</b> <b>2 marks</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> scale shown</li> <li>•<sup>2</sup> correct box and whiskers</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> suitable scale</li> <li>•<sup>2</sup> diagram drawn</li> </ul>
<b>c</b>	<b>ans: comparison</b> <b>1 mark</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> compares data</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> any suitable comparison</li> </ul>
		<b>Total</b> <b>30 marks</b>



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*Prelim Examination 2010/2011*

<p><b>MATHEMATICS</b> <b>National Qualifications - Intermediate 2</b> <b>Maths 1 and 2</b> <b>Paper 2</b></p>
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**Time allowed - 1 hour 30 minutes**

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**Read carefully**

1. **Calculators may be used in this paper.**
2. **Full credit will be given only where the solution contains appropriate working.**
3. **Square-ruled paper is provided.**



## FORMULAE LIST

The roots of  $ax^2 + bx + c = 0$  are  $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Sine rule:  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule:  $a^2 = b^2 + c^2 - 2bc \cos A$  or  $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle:  $\text{Area} = \frac{1}{2} ab \sin C$

Volume of a sphere:  $\text{Volume} = \frac{4}{3} \pi r^3$

Volume of a cone:  $\text{Volume} = \frac{1}{3} \pi r^2 h$

Volume of a cylinder:  $\text{Volume} = \pi r^2 h$

Standard deviation:  $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}} = \sqrt{\frac{\sum x^2 - (\sum x)^2/n}{n-1}}$ , where n is the sample size.

1. In the Garden centre there are 2 types of plants on special offer.



This week's  
 specials!  
 Rose bushes  
 and  
 Poppy plants



Carly bought 3 Rose bushes and 2 Poppy plants which cost £15.23

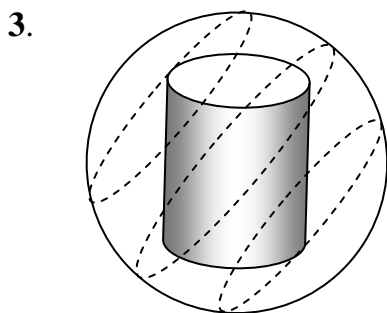
Steph paid £26.71 for 4 Poppy plants and 5 Rose bushes.

How much would Sally pay for a Rose bush and 3 Poppy plants?

**5**

2. Multiply and collect like terms  $(2x - 3)(x^2 + 5x - 6)$

**3**



A Christmas bauble is made from a sphere of perspex with a coloured cylinder in the middle. The volume round the cylinder is filled with a thick liquid.

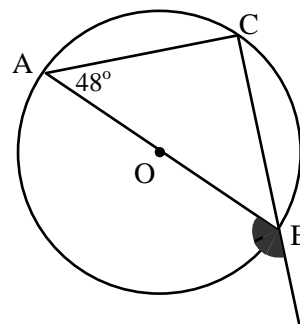
The sphere has a diameter of 8 cm. The cylinder has a radius of 2.6 cm with a height of 6 cm.

Calculate the volume of liquid needed to fill the sphere, giving your answer correct to 2 significant figures.

**5**

4. The diagram shows a circle centre O. AB is a diameter and C is a point on the circumference of the circle.

Calculate the size of the shaded angle.



5. In Bramley's Toy Shop there are 6 styles of teddy bear. The price of each is shown below.

£19   £25   £17   £32   £20   £22

- (a) Calculate the mean and standard deviation of these prices.



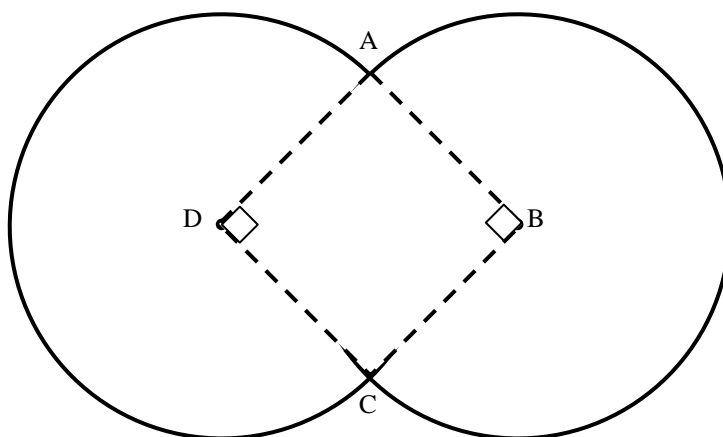
4

In the same shop the prices of the dolls have a mean of £22.50 and a standard deviation of 2.3.

- (b) Compare the two sets of data making particular reference to the spread of the prices.

1

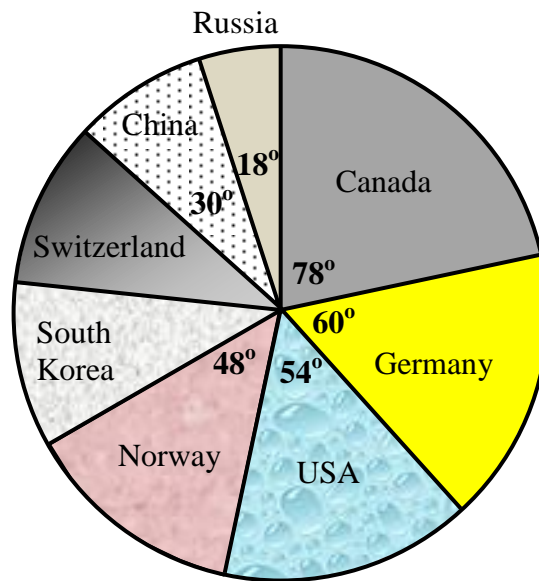
6. Two congruent circles overlap to form the symmetrical shape shown below. Each circle has a diameter of 12 cm and have centres at B and D.



Calculate the area of the shape.

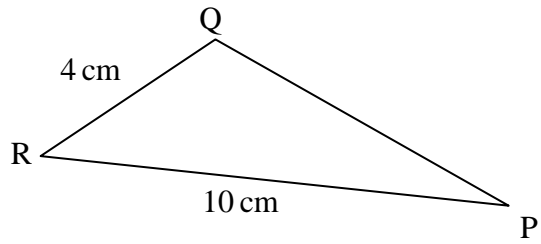
5

7. The pie chart shows the number of gold medals won by 8 countries in the 2010 Winter Olympics.



- (a) If Norway won 8 gold medals, how many did Canada win? 2
- (b) South Korea and Switzerland won the same number of gold medals. What percentage of the gold medals did each of these countries win? 2
8. Marcus invested £3000 in a bank which paid 2.5% interest per year.
- (a) Calculate how much money Marcus would have in his account after 3 years. 3
- (b) How long would it take for Marcus' money to increase by 12%? 3
9. Factorise  $4x^2 - 17x - 15$  2

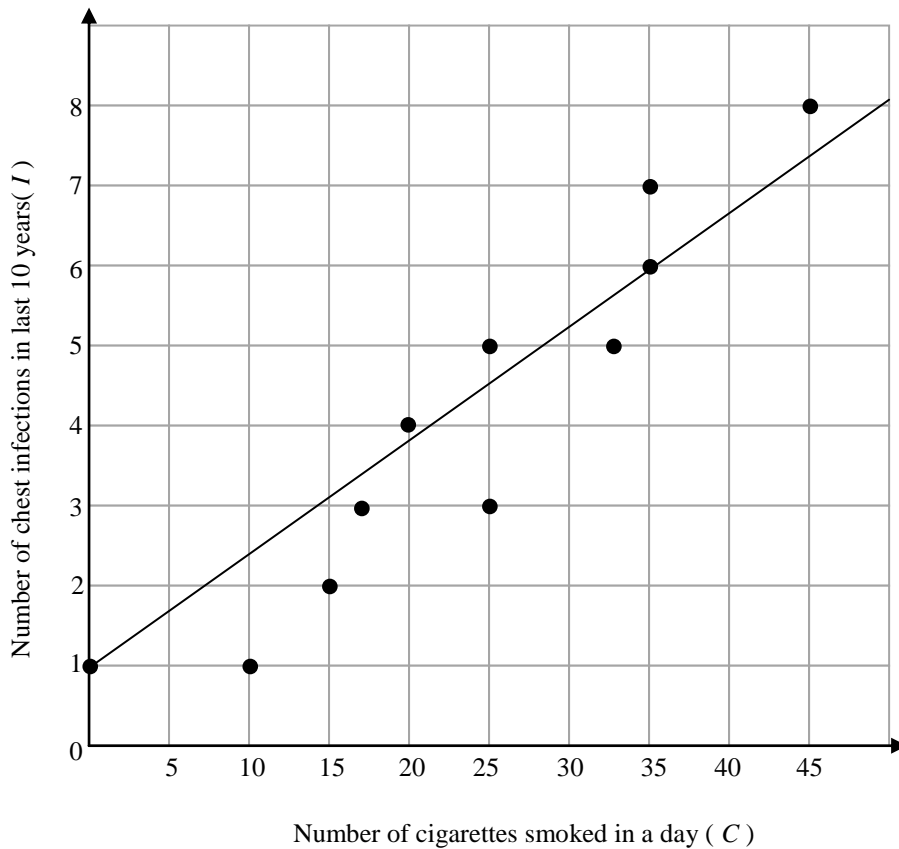
10. In triangle PQR, PR = 10 cm  
 QR = 4 cm. The perimeter of  
 the triangle is 22 cm.



Find the size of angle PQR.

4

11. A group of smokers were asked how many cigarettes they smoked in a day and how many chest infections they had suffered in the last ten years. The results are shown in the scattergraph with the line of best fit drawn.



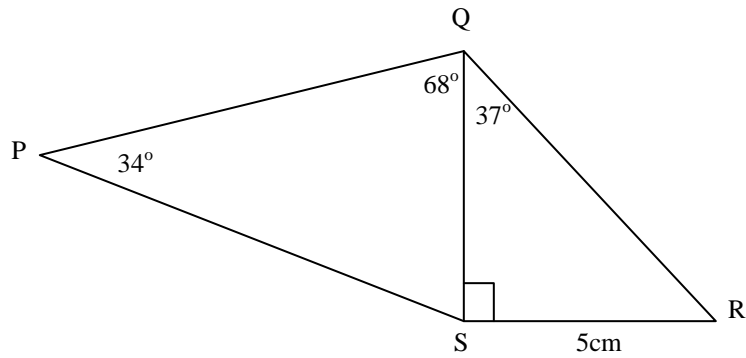
- (a) Comment on the correlation between the 2 sets of data.

1

- (b) Find the equation of the line of best fit.

2

12. In the diagram shown  $SR = 5\text{cm}$ , angle  $SQR = 37^\circ$ , angle  $QPS = 34^\circ$  and angle  $PQS = 68^\circ$ .



Calculate the length of  $PS$ .

**5**

*End of question paper*

Qu	Answer and Marks	Examples of Evidence
1	ans : £9.72 <span style="float:right">5 marks</span> <ul style="list-style-type: none"> <li>•<sup>1</sup> sets up equations</li> <li>•<sup>2</sup> strategy for solving equations</li> <li>•<sup>3</sup> solves for one variable</li> <li>•<sup>4</sup> finds other variable</li> <li>•<sup>5</sup> substitutes values and calculates cost</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>3R + 2P = 15.23; 5R + 4P = 26.71</math></li> <li>•<sup>2</sup> evidence of scaling equations</li> <li>•<sup>3</sup> <math>R = 3.75</math></li> <li>•<sup>4</sup> <math>P = 1.99</math></li> <li>•<sup>5</sup> <math>3.75 + 3 \times 1.99 = 9.72</math></li> </ul>
2	ans: $2x^3 + 7x^2 - 27x + 18$ <span style="float:right">3 marks</span> <ul style="list-style-type: none"> <li>•<sup>1</sup> starts to multiply brackets</li> <li>•<sup>2</sup> completes multiplying brackets</li> <li>•<sup>3</sup> simplifies</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>2x^3 + 10x^2 - 12x \dots\dots</math></li> <li>•<sup>2</sup> <math>\dots\dots - 3x^2 - 15x + 18</math></li> <li>•<sup>3</sup> <math>2x^3 + 7x^2 - 27x + 18</math> [must include <math>x^3</math> term]</li> </ul>
3	ans : $140 \text{ cm}^3$ <span style="float:right">5 marks</span> <ul style="list-style-type: none"> <li>•<sup>1</sup> strategy</li> <li>•<sup>2</sup> subs values into formula for sphere</li> <li>•<sup>3</sup> subs values into formula for cylinder</li> <li>•<sup>4</sup> subtracts to answer</li> <li>•<sup>5</sup> correct rounding</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> finding 2 volumes and subtracting</li> <li>•<sup>2</sup> <math>V_{\text{sphere}} = 4/3 \times \pi \times 4^3 = 268.0825731</math></li> <li>•<sup>3</sup> <math>V_{\text{cylinder}} = \pi \times 2.6^2 \times 6 = 127.422998</math></li> <li>•<sup>4</sup> 140.6595751</li> <li>•<sup>5</sup> <math>140 \text{ cm}^3</math></li> </ul>
4	ans : $138^\circ$ <span style="float:right">3 marks</span> <ul style="list-style-type: none"> <li>•<sup>1</sup> recognises angle in semi-circle</li> <li>•<sup>2</sup> uses angle in a triangle</li> <li>•<sup>3</sup> uses angle in straight line</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> angle <math>ACB = 90^\circ</math></li> <li>•<sup>2</sup> <math>180 - (48 + 90) = 42^\circ</math></li> <li>•<sup>3</sup> <math>180 - 42 = 138^\circ</math></li> </ul>
5a	ans : £22.50, 5.4 <span style="float:right">4 marks</span> <ul style="list-style-type: none"> <li>•<sup>1</sup> calculates mean</li> <li>•<sup>2</sup> squares deviations and adds</li> <li>•<sup>3</sup> substitutes into formula</li> <li>•<sup>4</sup> calculates standard deviation</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\pounds 135 \div 6 = \pounds 22.50</math></li> <li>•<sup>2</sup> <math>12.25 + 6.25 + 30.25 + 90.25 + 6.25 + 0.25 = 145.5</math></li> <li>•<sup>3</sup> <math>SD = \sqrt{(145.5/5)}</math></li> <li>•<sup>4</sup> 5.4</li> </ul>
b	ans : appropriate statement <span style="float:right">1 mark</span> <ul style="list-style-type: none"> <li>•<sup>1</sup> appropriate comment re spread</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> prices of dolls are less spread out than teddies</li> </ul>
6	ans : $205.6 \text{ cm}^2$ <span style="float:right">5 marks</span> <ul style="list-style-type: none"> <li>•<sup>1</sup> realises sector of circle</li> <li>•<sup>2</sup> uses correct radius</li> <li>•<sup>3</sup> finds area of one sector</li> <li>•<sup>4</sup> finds area of square</li> <li>•<sup>5</sup> finds total area</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>270/360 \dots\dots</math></li> <li>•<sup>2</sup> <math>r = 6 \text{ cm}</math> [could be in formula]</li> <li>•<sup>3</sup> <math>\dots\dots \times \pi \times 6^2 \times 2 = 169.646 \dots</math></li> <li>•<sup>4</sup> <math>6 \times 6 = 36</math></li> <li>•<sup>5</sup> <math>205.6 \text{ cm}^2</math></li> </ul>

Qu	Answer and Marks	Examples of Evidence
7a	ans : 13 gold medals 2 marks	<ul style="list-style-type: none"> <li>•<sup>1</sup> 48° represents 8 medals; 6° one medal</li> <li>•<sup>2</sup> <math>78 \div 6 = 13</math> medals</li> </ul>
	<ul style="list-style-type: none"> <li>•<sup>1</sup> equates angle to number of medals</li> <li>•<sup>2</sup> finds number of medals</li> </ul>	
b	ans : 10% 2 marks	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>360 - (18 + 30 + 78 + 60 + 54 + 48) = 72</math></li> <li>•<sup>2</sup> <math>36 \div 360 \times 100 = 10\%</math></li> </ul>
	<ul style="list-style-type: none"> <li>•<sup>1</sup> finds total of others</li> <li>•<sup>2</sup> subtracts and divides</li> </ul>	
8a	ans : £3 230.67 3 marks	<ul style="list-style-type: none"> <li>•<sup>1</sup> .... <math>\times 1.025</math></li> <li>•<sup>2</sup> <math>3\,000 \times 1.025^3</math></li> <li>•<sup>3</sup> £3 230.67</li> </ul>
	<ul style="list-style-type: none"> <li>•<sup>1</sup> uses correct multiplier</li> <li>•<sup>2</sup> knows how to increase</li> <li>•<sup>3</sup> answer</li> </ul>	
b	ans : 5 years 3 marks	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>3\,000 \times 1.12 = 3\,360</math></li> <li>•<sup>2</sup> trial and error [<math>3\,000 \times 1.025^n</math>]</li> <li>•<sup>3</sup> 5 years</li> </ul>
	<ul style="list-style-type: none"> <li>•<sup>1</sup> increases by 12%</li> <li>•<sup>2</sup> strategy</li> <li>•<sup>3</sup> answer</li> </ul>	
9	ans : $(4x + 3)(x - 5)$ 2 marks	<ul style="list-style-type: none"> <li>•<sup>1</sup> first factor correct</li> <li>•<sup>2</sup> second factor correct</li> </ul> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> Award 1 mark if signs round the wrong way. Signs must be different. </div> <ul style="list-style-type: none"> <li>•<sup>1</sup> <math>(4x + 3).....</math></li> <li>•<sup>2</sup> <math>.....(x - 5)</math></li> </ul>
10	ans : $108 \cdot 2^\circ$ 4 marks	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>22 - (4 + 10) = 8</math> cm</li> <li>•<sup>2</sup> evidence</li> <li>•<sup>3</sup> <math>(4^2 + 8^2 - 10^2) \div (2 \times 4 \times 8) = -0.3125</math></li> <li>•<sup>4</sup> <math>108 \cdot 2^\circ</math></li> </ul>
11a	ans : strong positive 1 mark	<ul style="list-style-type: none"> <li>•<sup>1</sup> strong positive correlation</li> </ul>
	<ul style="list-style-type: none"> <li>•<sup>1</sup> comment on correlation</li> </ul>	
b	ans : $I = 1/7C + 1$ 2 marks	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>m = 5/35 = 1/7; c = 1</math></li> <li>•<sup>2</sup> <math>I = 1/7C + 1</math></li> </ul>
	<ul style="list-style-type: none"> <li>•<sup>1</sup> finds gradient and y – intercept</li> <li>•<sup>2</sup> states equation of line</li> </ul>	
12	ans : 11.0cm 5 marks	<ul style="list-style-type: none"> <li>•<sup>1</sup> uses SOH CAH TOA</li> <li>•<sup>2</sup> 6.635...cm</li> <li>•<sup>3</sup> evidence</li> <li>•<sup>4</sup> <math>6.635.../\sin 34^\circ = PS/\sin 68^\circ;</math> <math>PS = 6.635... \cdot \sin 68^\circ / \sin 34^\circ</math></li> <li>•<sup>5</sup> 11.0cm</li> </ul> [ignore premature rounding]
		<b>Total</b> <span style="float: right;"><b>50 marks</b></span>