Firrhill High School
Prelim Examination 2010/2011

MATHEMATICS

Paper 1 (non-calculator)

Time allowed - 45 minutes

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 $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

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

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

Area of a triangle: Area = ½ $ab \sin C$

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

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

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

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

All questions should be attempted *Marks*

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

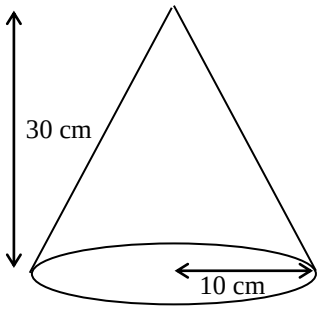
Find its gradient and y-intercept**.** **3**

2. Multiply the brackets and simplify

$$4x-(x-4)(2x+1)$$ **3**

3. Factorise $a^2 - 64b^2$ **2**

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



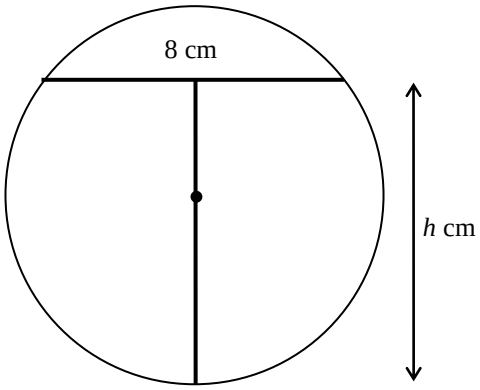
Taking $\pi = 3{\cdot}14$, calculate the volume of the cone. **3**

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

$$3x + 2y = 13$$
$$x = y + 1$$ **4**

6. 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

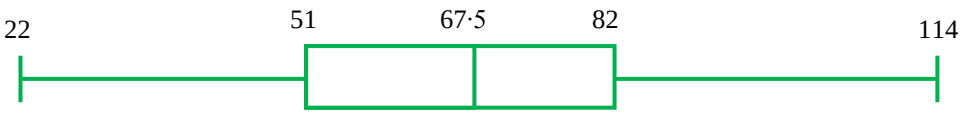
7. A group of S3 pupils produced the following set of Bleep Test results in PE before they started their Standard Grade course in August.

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**

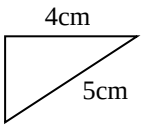
In December, the Bleep Test was repeated and this box plot drawn.



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

End of question paper

Paper 1 ~ 2010/11 **Marking Scheme**

Qu	Answer and Marks	Examples of Evidence
1	**ans : $m = -3$; (0, 4·5) 3 marks** •1 rearranges equation to $y = mx + c$ •2 states gradient •3 states y – axis intercept	•1 $y = -3x + 4{\cdot}5$ •2 $m = -3$ •3 $(0, 4{\cdot}5)$
4	**ans : $4 + 11x - 2x^2$ 3 marks** •1 multiplies brackets •2 simplifies •3 answer	•1 $4x - [2x^2 - 8x + x - 4]$ •2 $4x - 2x^2 + 7x + 4$ •3 $4 + 11x - 2x^2$
5	**ans : $(a - 8b)(a + 8b)$ 2 marks** •1 recognises diff. of two squares •2 factorises correctly	•1 evidence •2 $(a - 8b)(a + 8b)$
6	**ans : 3 140 cm³ 3 marks** •1 subs values into formula •2 attempts to simplify before calculation •3 answer	[No need to simplify- do not penalize if simplified] •1 $V = \frac{1}{3} \times 3{\cdot}14 \times 10^2 \times 30$ •2 evidence •3 $3\,140\ \text{cm}^3$
7	**ans : $x = 3$; $y = 2$ 4 marks** •1 subs for x •2 solves for y •3 knows to sub •4 solves for x	•1 $3(y + 1) + 2y = 13$ •1 $2x - 2y = 2$ •2 $y = 2$ •2 $x=3$ •3 subs for x •3 subs for y •4 $x = 3$ •4 $y = 2$
8	**ans : 8 cm 4 marks** •1 assembles facts in RAT •2 knows to use Pythagoras •3 finds missing side •4 answer	•1 •2 $\sqrt{(5^2 - 4^2)}$ •3 3 cm •4 3 + 5 = 8 cm 

Qu	Answer and Marks	Examples of Evidence
9a	**ans : 39; 58; 88 3 marks** •1 identifies lower quartile •2 identifies median •3 identifies upper quartile	•1 $Q_1 = 39$ •2 $Q_2 = 58$ •3 $Q_3 = 88$
b	**ans: box plot drawn 2 marks** •1 scale shown •2 correct box and whiskers	•1 suitable scale •2 diagram drawn
c	**ans: comparison 1 mark** •1 compares data	•1 any suitable comparison
		Total 25 marks

Firrhill High School
Prelim Examination 2010/2011

MATHEMATICS

Paper 2

Time allowed - 1 hour 30 minutes

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 $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

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

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

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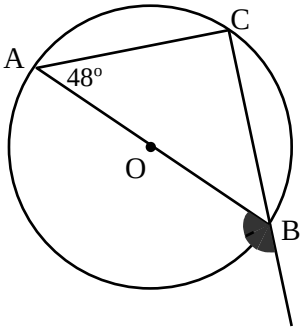
Volume of a cylinder: Volume = $\pi r^2 h$

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

All questions should be attempted *Marks*

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

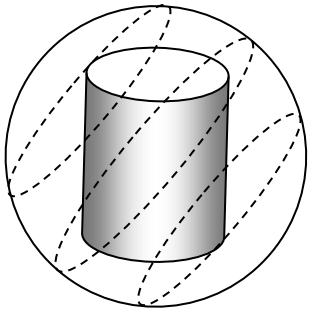
Calculate the size of the shaded angle.



3

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

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. 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**

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

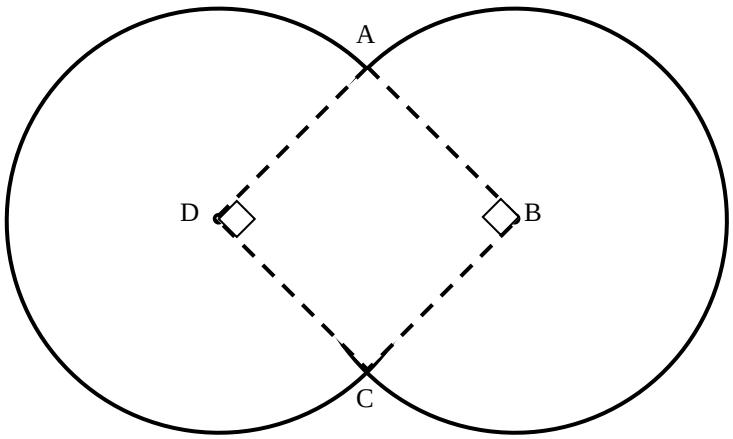
£19 £25 £17 £32 £20 £22

(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**

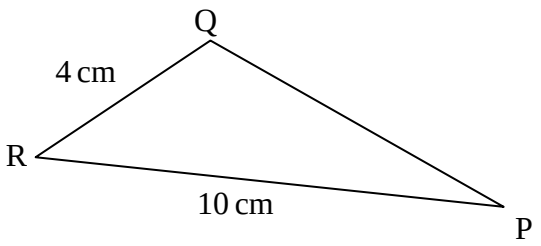
7. Marcus invested £3000 in a bank which paid 2·5% interest per year.

(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**

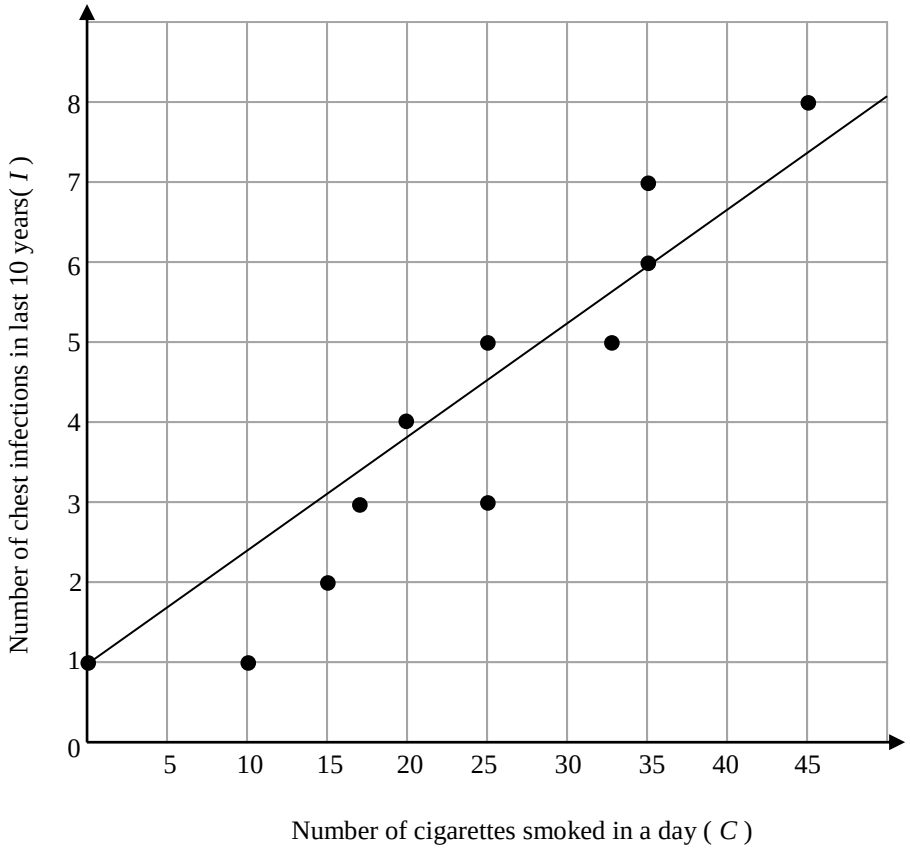
8. Factorise $4x^2 - 17x - 15$ **2**

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



Find the size of angle PQR. **4**

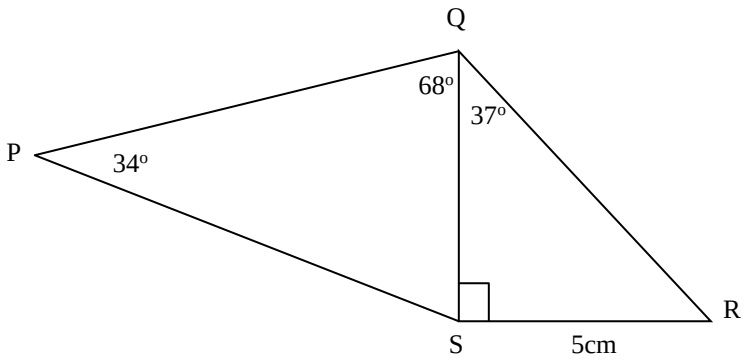
10. A group of smokers were asked how many cigarettes they smoked in a day and how many chest infections they had suffered in the last ten years. The results are shown in the scattergraph with the line of best fit drawn.



(a) Comment on the correlation between the 2 sets of data. **1**

(b) Find the equation of the line of best fit. **2**

11. In the diagram shown SR = 5cm, angle SQR = 37º, angle QPS = 34º and angle PQS = 68º.



Calculate the length of PS.

5

Intermediate 2 Paper 2 ~ 2010/11 **Marking Scheme**

Qu	Answer and Marks	Examples of Evidence
1	**ans : £9.72 5 marks** •[1] sets up equations •[2] strategy for solving equations •[3] solves for one variable •[4] finds other variable •[5] substitutes values and calculates cost	 •[1] 3R + 2P = 15·23; 5R + 4P = 26·71 •[2] evidence of scaling equations •[3] R = 3·75 •[4] P = 1·99 •[5] 3·75 + 3 × 1·99 = 9·72
2	**ans: $2x^3 + 7x^2 - 27x + 18$ 3 marks** •[1] starts to multiply brackets •[2] completes multiplying brackets •[3] simplifies	 •[1] $2x^3 + 10x^2 - 12x$…….. •[2] …… $- 3x^2 - 15x + 18$ •[3] $2x^3 + 7x^2 - 27x + 18$ [must include x^3 term]
3	**ans : 140 cm³ 5 marks** •[1] strategy •[2] subs values into formula for sphere •[3] subs values into formula for cylinder •[4] subtracts to answer •[5] correct rounding	 •[1] finding 2 volumes and subtracting •[2] $V_{sphere} = 4/3 \times \pi \times 4^3 = 268{\cdot}0825731$ •[3] $V_{cylinder} = \pi \times 2{\cdot}6^2 \times 6 = 127{\cdot}422998$ •[4] 140.6595751 •[5] 140 cm³
4	**ans : 138° 3 marks** •[1] recognises angle in semi-circle •[2] uses angle in a triangle •[3] uses angle in straight line	 •[1] angle ACB = 90° •[2] 180 – (48 + 90) = 42° •[3] 180 – 42 = 138°
5a	**ans : £22·50, 5·4 4 marks** •[1] calculates mean •[2] squares deviations and adds •[3] substitutes into formula •[4] calculates standard deviation	 •[1] £135 ÷ 6 = £22.50 •[2] 12·25 + 6·25 + 30·25 + 90·25 + 6·25 + 0·25 = 145·5 •[3] SD = √(145·5/5) •[4] 5·4
b	**ans : appropriate statement 1 mark** •[1] appropriate comment re spread	 •[1] prices of dolls are less spread out than teddies
6	**ans : 205·6 cm² 5 marks** •[1] realises sector of circle •[2] uses correct radius •[3] finds area of one sector •[4] finds area of square •[5] finds total area	 •[1] 270/360…….. •[2] r = 6 cm [could be in formula] •[3] ……$\times \pi \times 6^2 \times 2 = 169{\cdot}646$…. •[4] 6 × 6 = 36 •[5] 205·6 cm²

Qu	Answer and Marks	Examples of Evidence
7a	**ans : £3 230.67 3 marks**	
	•1 uses correct multiplier •2 knows how to increase •3 answer	•1 …. × 1·025 •2 $3\,000 \times 1{\cdot}025^3$ •3 £3 230.67
b	**ans : 5 years 3 marks**	
	•1 increases by 12% •2 strategy •3 answer	•1 $3\,000 \times 1{\cdot}12 = 3\,360$ •2 trial and error $[3\,000 \times 1{\cdot}025^n]$ •3 5 years
8	**ans : $(4x + 3)(x - 5)$ 2 marks**	
	•1 first factor correct •2 second factor correct	•1 $(4x + 3)$…… •2 ……$(x - 5)$
9	**ans : 108·2º 4 marks**	
	•1 finds missing side •2 knows to use cosine rule •3 subs values into rule •4 finds angle	•1 $22 - (4 + 10) = 8$ cm •2 evidence •3 $(4^2 + 8^2 - 10^2) \div (2 \times 4 \times 8) = -0{\cdot}3125$ •4 108·2º
10a	**ans : strong positive 1 mark**	Award 1 mark if signs round the wrong way. Signs must be different.
	•1 comment on correlation	•1 strong positive correlation
b	**ans : $I = 1/7C + 1$ 2 marks**	
	•1 finds gradient and y – intercept •2 states equation of line	•1 $m = 5/35 = 1/7$; $c = 1$ •2 $I = 1/7C + 1$
11	**ans : 11·0cm 5 marks**	
	•1 knows to find QS •2 answer •3 knows to use sine rule •4 subs values •5 answer	•1 uses SOH CAH TOA •2 6·6 35…cm •3 evidence •4 6·635../sin34º = PS/sin68º; PS = 6·6 35..sin68º/sin34º •5 11·0cm [ignore premature rounding]
		Total 46 marks