



Mark

Mathematics Department

National 5                      2013/14

Mathematics Paper 1

Duration: 1hr

Name of Centre:

Candidate Name:

**FORMULAE LIST**

The roots of

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

Sine rule:

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

Cosine rule:

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

Area of a triangle:

$$A = \frac{1}{2} ab \sin C$$

Volume of a sphere:

$$V = \frac{4}{3} \pi r^3$$

Volume of a cone:

$$V = \frac{1}{3} \pi r^2 h$$







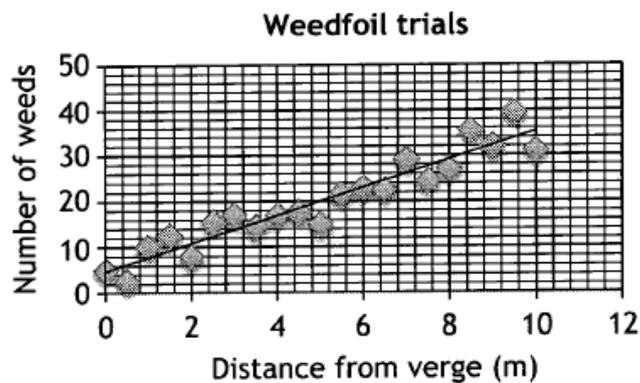
3. Expand and simplify

$$(3x - 2)(2x^2 + x + 5)$$

3

4. Weedkiller was sprayed along a grass verge. A week later the number of weeds found and their distance from the verge was noted.

A scatter diagram was constructed and a best fitting straight line drawn.



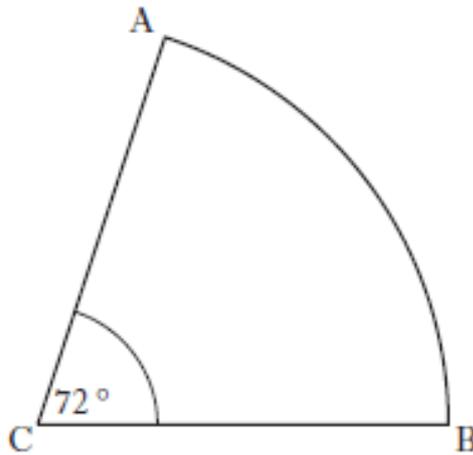
Four metres from the verge the line suggests that 17 weeds were found and that 10 m from the verge there should be 35 weeds.

- (a) Find the equation of the best fitting straight line. Justify your answer. 3
- (b) Use your equation to predict how many weeds can be expected 7 m from the verge. 1

**Total Marks 4**

5.

The diagram below shows a sector of a circle, centre C.



The radius of the circle is 5 centimetres and angle ACB is  $72^\circ$ .

Calculate the length of arc AB.

Take  $\pi = 3.14$ .

Total Marks 3



6. (a) Simplify this expression:

$$\frac{3x^{-3}}{x^{\frac{1}{2}}x^{-4}}$$

MARKS  
DO NOT  
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2

- (b) Calculate its value when  $x = 8$ .

1

Total Marks 3

7. Rationalise the denominator, leaving the fraction in its simplest form:

$$\frac{\sqrt{2}}{\sqrt{3}}$$

2

8. Seven friends went to a local fair. At the snack stall they were offered two different sandwich options. Everyone took one of them.

If only two chose the cheaper option, the total bill would come to £19.

- (a) Let £ $x$  be the cost of the cheaper and £ $y$  be the cost of the dearer option.  
Form an equation in  $x$  and  $y$ .

1

- (b) If three chose the cheaper option, the total bill would come to £18.

Form a second equation in  $x$  and  $y$ .

1

- (c) What would the total bill be if four chose the cheaper option?

3

Total Marks    5

9. To repoint a small garden wall, a stonemason will charge according to the formula:

$$C = 72 + 8h^2,$$

where £ $C$  is the cost and  $h$  metres is the height of the wall.

Make  $h$  the subject of the formula.

3

10. Express

$$\frac{4}{x+2} - \frac{3}{x-4}, \quad x \neq -2, x \neq 4$$

as a single fraction in its simplest form.

**Total Marks 3**

11.

(a) Factorise

$$a^2 + 2ab + b^2.$$

**1**

(b) Hence, or otherwise, find the value of

$$94^2 + 2 \times 94 \times 6 + 6^2.$$

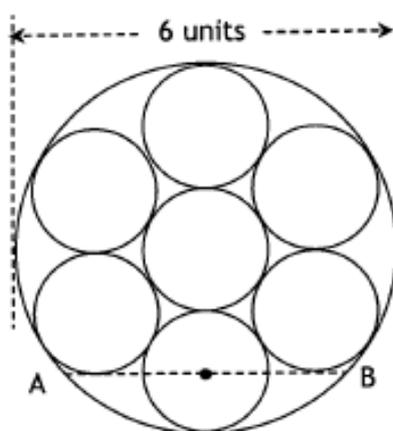
**2**

**Total Marks 3**

END OF QUESTION PAPER

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12. Seven identical fibre-optic cables fit snugly inside a larger pipe of diameter 6 units. The diagram below represents their cross-sections as circles.



- (a) What is the radius of one small cable? 1
- (b) The chord AB passes through the centre of one of the smaller cables. How far is this centre from the centre of the larger pipe? 1
- (c) What is the length of the chord AB? (Leave your answer in surd form.) 2

Total Marks 4

[END OF QUESTION PAPER]

## N5 Prelim Paper 1 Qs and related Assessment Standard

- Q1 Expressions and Formulae 1.2
- Q2 Applications 1.3
- Q3 Expressions and Formulae 1.2
- Q4 Relationships 1.1
- Q5 Expressions and Formulae 1.4
- Q6 Expressions and Formulae 1.1
- Q7 Expressions and Formulae 1.1
- Q8 Relationships 1.1
- Q9 Relationships 1.1
- Q10 Expressions and Formulae 1.3
- Q11 Relationships 1.4
- Q12 Relationships 1.4 and Expressions and Formulae 1.1

## N5 Prelim Paper 1 Sources

- 1 P & N 2013 – Purchased
- 2 P & N 2013 – Purchased
- 3 Official SQA Credit 2012 - P1 Q2
- 4 P & N 2013 – Purchased
- 5 Official SQA Intermediate 2 2013- P1 Q3
- 6 P & N 2013 – Purchased
- 7 P & N 2013 – Purchased
- 8 P & N 2013 – Purchased
- 9 P & N 2013 – Purchased
- 10 Official SQA Specimen Paper – P1 Q11
- 11 Official SQA Intermediate 2 2012- P1 Q8
- 12 P & N 2013 – Purchased
- 13 Hodder Gibson Official SQA Model Paper 2 P1 Q3

N5 Prelim Paper 1 Marking Scheme

Question	Marking scheme Give one mark for each •	Max mark	Illustration of evidence for awarding a mark at each •
1 a	<b>Answer: <math>(x + 1)(x + 2)(3x + 1)</math></b> • <sup>1</sup> expression from LBH	1	• <sup>1</sup> $(x + 1)(x + 2)(3x + 1)$
b	<b>Answer: <math>3x^3 + 10x^2 + 9x + 2</math></b> • <sup>1</sup> expand 1 pair • <sup>2</sup> expand and simplify	2	• <sup>1</sup> $= (x^2 + 3x + 2)(3x + 1)$ $= 3x^3 + 9x^2 + 6x + x^2 + 3x + 2$ • <sup>2</sup> $= 3x^3 + 10x^2 + 9x + 2$
2	<b>Answer: <math>2\frac{1}{3}</math> m/h</b> • <sup>1</sup> know to divide and start division • <sup>2</sup> complete division	2	• <sup>1</sup> $S = D \div T = 1\frac{3}{4} \div \frac{2}{3}$ • <sup>2</sup> $= \frac{7}{4} \times \frac{3}{2} = \frac{21}{8} = 2\frac{5}{8}$ m/h
3	<b>Answer: <math>x = -4</math> or <math>-\frac{1}{2}</math></b> • <sup>1</sup> begin to factorise • <sup>2</sup> complete factorisation • <sup>3</sup> interpret solutions	3	• <sup>1</sup> e.g. $(2x + 1) \dots$ • <sup>2</sup> $(2x + 1)(x + 4)$ • <sup>3</sup> $\Rightarrow x = -\frac{1}{2}$ or $x = -4$
4 a	<b>Answer: <math>y = 3x + 5</math></b> • <sup>1</sup> calculate gradient • <sup>2</sup> substitute in $y = mx + c$ to establish value of $c$ • <sup>3</sup> state equation of line	3	• <sup>1</sup> $m = \frac{35 - 17}{10 - 4} = \frac{18}{6} = 3$ • <sup>2</sup> $y = mx + c \Rightarrow 17 = 3 \cdot 4 + c \Rightarrow c = 5$ • <sup>3</sup> $y = 3x + 5$
b	<b>Answer: 26 weeds</b> • <sup>1</sup> calculate no of weeds using equation	1	• <sup>1</sup> when $x = 7, y = 3 \cdot 7 + 5 = 26$

5

<b>Ans: 6.28 cm</b>	3
• <sup>1</sup> strategy: know to express arc as fraction of a circle	• <sup>1</sup> $\frac{72}{360}$
• <sup>2</sup> strategy: know how to find length of arc	• <sup>2</sup> $\frac{72}{360} \times 3 \cdot 14 \times 2 \times 5$
• <sup>3</sup> process: correctly calculate length of arc	• <sup>3</sup> 6.28

6 a	<b>Answer:</b> $3x^{\frac{5}{3}}$ • <sup>1</sup> use law of indices to simplify or combine factors • <sup>2</sup> use law of indices to simplify	2	• <sup>1</sup> $3x^{-3} \cdot x^{-\frac{1}{3}} \cdot x^4 = 3x^{(-3-\frac{1}{3}+4)}$ • <sup>2</sup> $= 3x^{1-\frac{1}{3}} = 3x^{\frac{2}{3}}$
b	<b>Answer:</b> 12 • <sup>1</sup> calculate $x^{\frac{3}{2}}$ when $x = 8$	1	When $x = 8$ • <sup>1</sup> $3x^{\frac{3}{2}} = 3 \times 8^{\frac{3}{2}} = 3 \times 2^2 = 12$
7	<b>Answer:</b> $\frac{\sqrt{6}}{3}$ • <sup>1</sup> multiply num <sup>r</sup> and den <sup>r</sup> by den <sup>r</sup> • <sup>2</sup> simplify	2	• <sup>1</sup> $\frac{\sqrt{2}}{\sqrt{3}} = \frac{\sqrt{2} \cdot \sqrt{3}}{\sqrt{3} \cdot \sqrt{3}} =$ • <sup>2</sup> $\frac{\sqrt{6}}{\sqrt{9}} = \frac{\sqrt{6}}{3}$
8 a	<b>Answer:</b> $2x + 5y = 19$ • <sup>1</sup> marshal facts and form equation	1	2 cheap and 5 dear = 19 • <sup>1</sup> i.e. $2x + 5y = 19$
b	<b>Answer:</b> $3x + 4y = 18$ • <sup>1</sup> marshal facts and form equation	1	3 cheap and 4 dear = 18 • <sup>1</sup> i.e. $3x + 4y = 18$
c	<b>Answer:</b> £17 • <sup>1</sup> scale equations • <sup>2</sup> solve for one variable by elimination • <sup>3</sup> solve for other variable and Answer: question	3	$\begin{array}{r} 2x + 5y = 19 \quad \dots \textcircled{1} \\ 3x + 4y = 18 \quad \dots \textcircled{2} \end{array}$ • <sup>1</sup> $\textcircled{1} \times 3 \quad 6x + 15y = 57 \quad \dots \textcircled{3}$ • <sup>2</sup> $\textcircled{2} \times 2 \quad 6x + 8y = 36 \quad \dots \textcircled{4}$ • <sup>3</sup> $\textcircled{3} - \textcircled{4} \quad 7y = 21 \Rightarrow y = 3$ Substitute in $\textcircled{1}$ : $2x + 15 = 19 \Rightarrow x = 2$ • <sup>3</sup> 4 cheap + 3 dear = $8 + 9 = 17$
9	<b>Answer:</b> $h = \sqrt{\frac{C-72}{8}}$ • <sup>1</sup> make $8h^2$ the subject • <sup>2</sup> make $h^2$ the subject • <sup>3</sup> make $h$ the subject	3	• <sup>1</sup> $8h^2 = C - 72$ • <sup>2</sup> $\Rightarrow h^2 = \frac{C-72}{8}$ • <sup>3</sup> $\Rightarrow h = \sqrt{\frac{C-72}{8}}$

10

	<b>Ans:</b> $\frac{x-22}{(x+2)(x-4)}$ • <sup>1</sup> correct common denominator • <sup>2</sup> correct numerator • <sup>3</sup> simplify	3	• <sup>1</sup> $(x+2)(x-4)$ • <sup>2</sup> $4(x-4) - 3(x+2)$ • <sup>3</sup> $\frac{x-22}{(x+2)(x-4)}$
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11

(a)	<b>Ans:</b> $(a + b)^2$ • <sup>1</sup> process: factorise $a^2 + 2ab + b^2$	• <sup>1</sup> $(a + b)^2$  <div style="text-align: right;"><b>1 mark</b></div>
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ES:

(b)	<b>Ans:</b> 10 000 • <sup>1</sup> strategy: know to substitute in expression • <sup>2</sup> process: evaluate expression	• <sup>1</sup> $(94 + 6)^2$ • <sup>2</sup> 10 000  <div style="text-align: right;"><b>2 marks</b></div>
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ES:

1. Alternative method for 1st mark

- <sup>1</sup> strategy: know correct order of operations
- <sup>1</sup> evidence

2. For a correct answer without working

award 0/2

<b>12</b>	<b>a</b>	<b>Answer: 1 unit</b> • <sup>1</sup> insight ... 6 radii make 6 units	<b>1</b>	• <sup>1</sup> diameters of 3 small circles make diameter of large ... i.e. 6 radii $6 \div 6 = 1$ unit
	<b>b</b>	<b>Answer: 2 units</b> • <sup>1</sup> insight ... 2 radii make distance	<b>1</b>	• <sup>1</sup> distance is made of 2 small radii. $\text{distance} = 2 \times 1 = 2$ units
	<b>c</b>	<b>Answer: <math>2\sqrt{5}</math> mm</b> • <sup>1</sup> insight to use convenient radius • <sup>2</sup> use Pythagoras	<b>2</b>	• <sup>1</sup> draw radius of large circle from centre to B ... forming a right angled triangle • <sup>2</sup> $\text{distance} = \sqrt{(3^2 - 2^2)} = \sqrt{5}$ , so $AB = 2\sqrt{5}$

13 **Answer: -4**

- Sub in -3 for x 1  $5 - (-3)^2$
- Calculate 1 -4

