



Mark

Mathematics Department

National 5 2013/14

Mathematics Paper 2

Duration: 1hr 30mins

Name of Centre:

Candidate Name:

Teacher:

Total marks – 49

You may use a calculator.

Attempt ALL questions.

Use **blue** or **black** ink. Pencil may be used for graphs and diagrams only.

Write your working and answers in the spaces provided. Additional space for answers is provided at the end of this booklet. If you use this space, write clearly the number of the question you are attempting.

Square-ruled paper is provided at the back of this booklet.

Full credit will be given only to solutions which contain appropriate working.

State the units for your answer where appropriate.

Before leaving the examination room you must give this booklet to the invigilator.

If you do not, you may lose all the marks for this paper.

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

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

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

Volume of a pyramid: $V = \frac{1}{3} Ah$

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. The Earth travels around the sun at a speed of 3.0×10^4 metres per second.
The journey takes 3.16×10^7 seconds.
Use the fact that *Distance = Speed \times Time* to calculate the distance the Earth travels to go once around the sun. Give your answer in scientific notation. 2
2. Florence bought a car last year. She had it valued this year for insurance purposes and discovered it had depreciated by 5%.
The car is now only worth £8208.
What did Florence pay last year for the car? 3
3. Margery's boss has asked her to take a pay cut of 10% this year because of the recession, on the promise that next year she will have her wages increased by 11%.
Margery earns £24 000. What will she be earning after a 10% cut followed by an 11% increase? Compare this to her original pay. 3

4. Express $x^2 + 10x + 17$ in the form $(x + p)^2 + q$

Total marks 2

The marks obtained in a class test were as follows:

22	27	37	16	31	20	25
37	40	22	37	28	29	33

- (a) For this data set:

- (i) state the minimum and maximum values
(ii) find the median and quartiles

3

- 5.

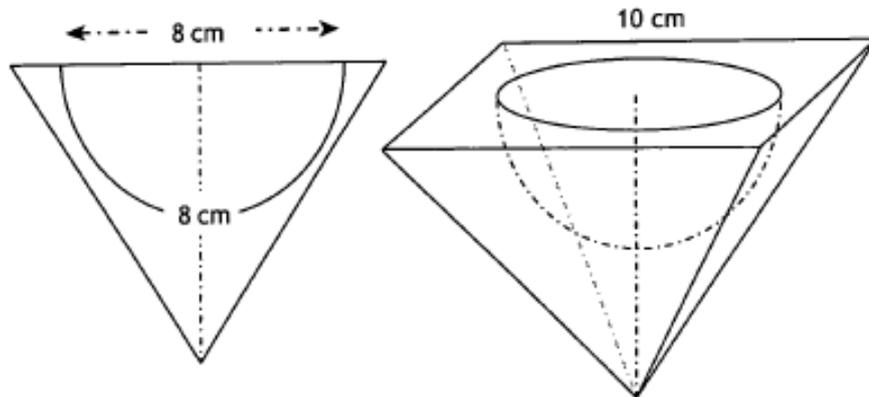
- (a)
(b)

	MARKS	DO NOT WRITE IN THIS MARGIN
6. At the Rugby Sevens Competition the weights of the Scottish players were: 85 kg, 80 kg, 81 kg, 91 kg, 95 kg, 92 kg, 90 kg.		
(a) Calculate the mean weight and the standard deviation.	3	
(b) The American team in the competition had a mean weight of 88.0 kg and a standard deviation of 8.3 kg. Make two valid comparisons between the two teams.	2	
	Total Marks	5

7. A glass bowl to hold sweets is made from a square based pyramid of height 8 cm. From this is hollowed out a hemisphere of radius 4 cm.

The square has a side of 10 cm.

Wooden legs keep it stable.

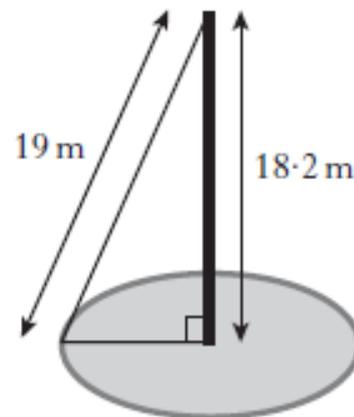


Calculate the volume of glass making the bowl, correct to 3 significant figures.

5

A mobile phone mast, 18.2 metres high, stands vertically in the centre of a circle.

It is supported by a wire rope, 19 metres long, attached to the ground at a point on the circumference of the circle, as shown.



Calculate the circumference of the circle.

8.

Total Marks 3

Shampoo is available in travel size and salon size bottles.
The bottles are mathematically similar.



The travel size contains 200 millilitres and is 12 centimetres in height.
The salon size contains 1600 millilitres.
Calculate the height of the salon size bottle.

9.



Total Marks 3

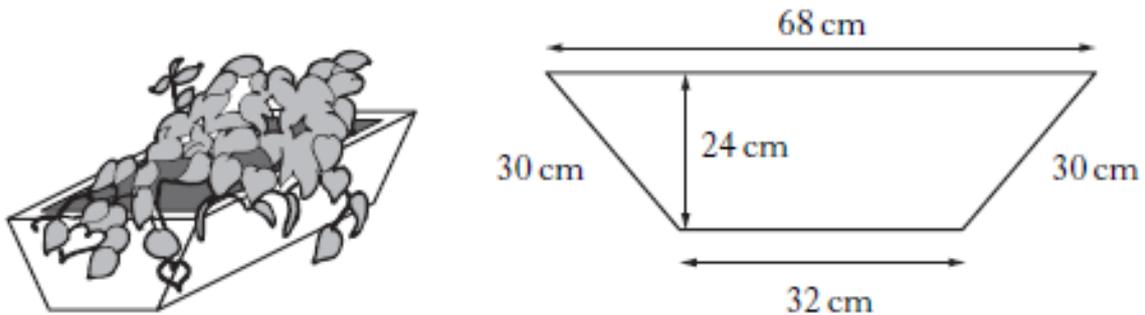
10. Sketch the graph of $y = 7\sin 2x^\circ$ for $0 \leq x \leq 360$. **eight**

Total Marks 3

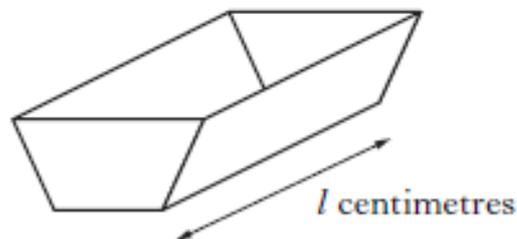
11.

A flower planter is in the shape of a prism.

The cross-section is a trapezium with dimensions as shown.



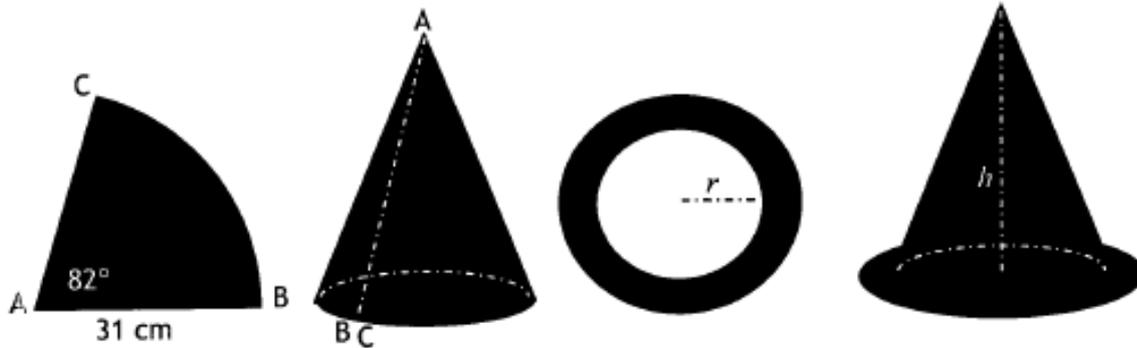
- (a) Calculate the area of the cross-section of the planter.
- (b) The volume of the planter is 156 litres.



Calculate the length, l centimetres, of the planter.

Total Marks 5

12. Peter is making a wizard's hat out of black paper for his son's Hallowe'en costume. He cuts out the sector of a circle ABC, where radius $AB = 31$ cm and $\angle BAC = 82^\circ$. He then joins AB to AC to form a cone. Finally he fits a circular rim to complete the hat.

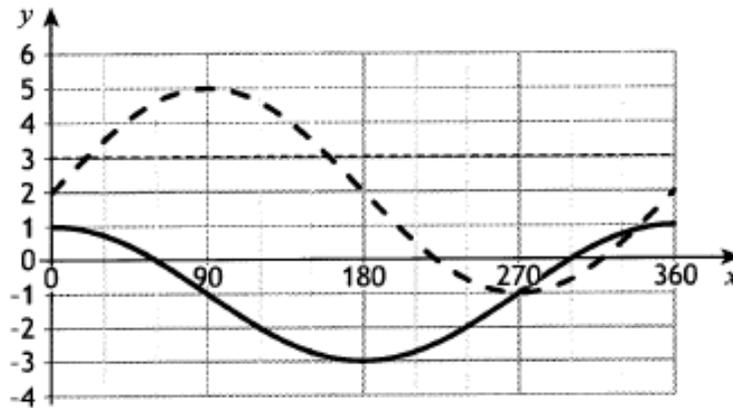


- (a) Calculate the length of the arc BC. 2
- (b) State the inner circumference of the rim and hence calculate the inner radius of the rim. 2
- (c) What is the height of the hat? 3

Total Marks 7

MARKS DO NOT WRITE IN THIS MARGIN

13. The graph shows sketches of two curves.



The broken curve has equation $y = 3 \sin x^\circ + 2$.

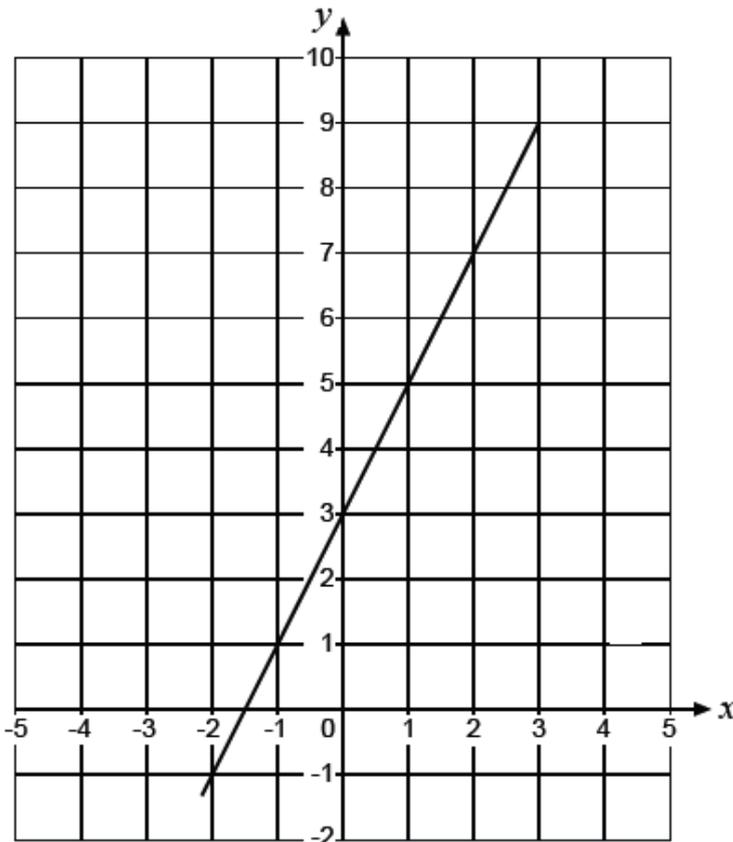
The solid curve has equation of the form $y = a \cos x^\circ + b$.

By examining the solid curve, state the values of a and b .

2

14 Find the equation of the line shown in the diagram below.

3



END OF QUESTION PAPER

N5 Prelim Paper 2 Qs and related Assessment Standard

- Q1 Expressions and Formulae 1.1
- Q2 Applications 1.3
- Q3 Applications 1.3
- Q4 Expressions and Formulae 1.2
- Q5 Applications 1.4
- Q6 Applications 1.4
- Q7 Expressions and Formulae 1.4
- Q8 Expressions and Formulae 1.4
- Q9 Relationships 1.4
- Q10 Relationships 1.5
- Q11 Expressions and Formulae 1.4
- Q12 Expressions and Formulae 1.4
- Q13 Relationships 1.5
- Q14 Relationships 1.1

N5 Prelim Paper Sources

- 1 P & N 2013 – Purchased
- 2 P & N 2013 – Purchased
- 3 P & N 2013 – Purchased
- 4 Hodder Gibson Official SQA Model Papers – Model Paper 2, P1 Q6
- 5 Official Intermediate 2 Unit Assessment Bank D322/11001 Q5a
- 6 P & N 2013 – Purchased
- 7 P & N 2013 – Purchased
- 8 Official SQA Credit 2013 – P2 Q6
- 9 Official SQA Credit 2010 – P2 Q7
- 10 Perfect Papers Int 2 Prelim 2007 – P2 Q4
- 11 Official SQA Credit 2011 – P2 Q9
- 12 P & N 2013 – Purchased
- 13 P & N 2013 – Purchased
- 14 Official Intermediate 2 Unit Assessment Bank D321/11001 Q8

1	Answer: 9.48×10^{11} metres $S = 3.0 \times 10^4 \times 3.16 \times 10^7$ <ul style="list-style-type: none"> •¹ product of numbers •² product of powers of 10 	2	<ul style="list-style-type: none"> •¹ $3.0 \times 3.16 = 9.48$ •² $10^4 \times 10^7 = 10^{11}$ $= 9.48 \times 10^{11}$
2	Answer: £8640 <ul style="list-style-type: none"> •¹ strategy for 1% •² strategy for 100% •³ process to Answer: 	3	<ul style="list-style-type: none"> •¹ 95% gives £8208 So 1% is $£8208 \div 95$ •² So 100% is $(£8208 \div 95) \times 100$ •³ = £8640
3	Answer: £23 976 ... £24 down <ul style="list-style-type: none"> •¹ calculate % reduction •² calculate % increase •³ subtract from 24 000 and comment 	3	<ul style="list-style-type: none"> •¹ $24000 \times 0.9 = 21600$ •² $21600 \times 1.11 = 23976$ •³ $24000 - 23976 = 24$ She's getting paid £24 a year less than when she started.

Note Q 2 – 1st mark given if 95% = £8208 as per 2010 P1 Q6

Q3 – 3rd mark given if comparison still true despite error from 2nd mark.

4	<ul style="list-style-type: none"> •¹ identify minimum and maximum marks 	<ul style="list-style-type: none"> •¹ 16 and 40 	<ul style="list-style-type: none"> • $(x + 5)^2 \dots$ • $\dots - 8$
5	<ul style="list-style-type: none"> •² identify median •³ identify lower and upper quartile 	<ul style="list-style-type: none"> •² 28.5 •³ 22 and 37 	

6 a	Answer: mean 87.7 kg; sd = 5.8 kg <ul style="list-style-type: none"> •¹ calculate mean •² table of values leading to $\sum x^2 = 54056$ •³ standard deviation calculated 	3	<ul style="list-style-type: none"> •¹ $\bar{x} = \frac{\sum x}{n} = \frac{614}{7} = 87.7 \text{ kg (1 d.p.)}$ •² <table border="1"> <thead> <tr> <th>x</th> <th>x^2</th> </tr> </thead> <tbody> <tr><td>85</td><td>7225</td></tr> <tr><td>80</td><td>6400</td></tr> <tr><td>81</td><td>6561</td></tr> <tr><td>91</td><td>8281</td></tr> <tr><td>95</td><td>9025</td></tr> <tr><td>92</td><td>8464</td></tr> <tr><td>90</td><td>8100</td></tr> <tr><td>614</td><td>54056</td></tr> </tbody> </table> •³ $s = \sqrt{\frac{54056 - 614^2 / 7}{6}} = 5.8 \text{ kg (1 d.p.)}$ 	x	x^2	85	7225	80	6400	81	6561	91	8281	95	9025	92	8464	90	8100	614	54056
x	x^2																				
85	7225																				
80	6400																				
81	6561																				
91	8281																				
95	9025																				
92	8464																				
90	8100																				
614	54056																				
b	Answer: comparisons <ul style="list-style-type: none"> •¹ compare/interpret means •² compare/interpret spread 	2	<ul style="list-style-type: none"> •¹ means are very similar •² US weights much more variable 																		
7	Answer: 133 cm^3 (3 s.f.) <ul style="list-style-type: none"> •¹ strategy for Volume of glass •² calculate volume pyramid •³ calculate volume hemisphere •⁴ calculate volume glass •⁵ required rounding 	5	<ul style="list-style-type: none"> •¹ $V_{\text{glass}} = V_{\text{pyramid}} - V_{\text{hemisphere}} \text{ (s/i)}$ •² $V_{\text{pyramid}} = \frac{1}{3} \times 10^2 \times 8 = 266.666\dots$ •³ $V_{\text{hemisphere}} = \frac{1}{2} \times \frac{4}{3} \times \pi \times 4^3 = 134.041\dots$ •⁴ $V_{\text{glass}} = 266.66\dots - 134.04\dots = 132.62\dots$ •⁵ = 133 cm^3 to 3 s.f. 																		

Ans: 34.3 m	3	
• ¹ correct use of Pythagoras		• ¹ $r^2 = 19^2 - 18 \cdot 2^2$
• ² calculating radius		• ² 5.455
• ³ calculating circumference		• ³ 34.3

8

Give 1 mark for each •	Illustrations of evidence for awarding each mark
Ans: 24 cm <ul style="list-style-type: none"> • volume scale factor • linear scale factor • calculating height 	<ul style="list-style-type: none"> • 8 or equivalent • $\sqrt[3]{8}$ • 24 <p style="text-align: right;">3KU</p>
for 96 with or without working	award 2/3

9
10

9 (a)	<p>Ans: 1200 cm²</p> <ul style="list-style-type: none"> • calculation of 1 area • composite area 	<ul style="list-style-type: none"> • 216, 432, 768 or 1632 • 1200 	2KU
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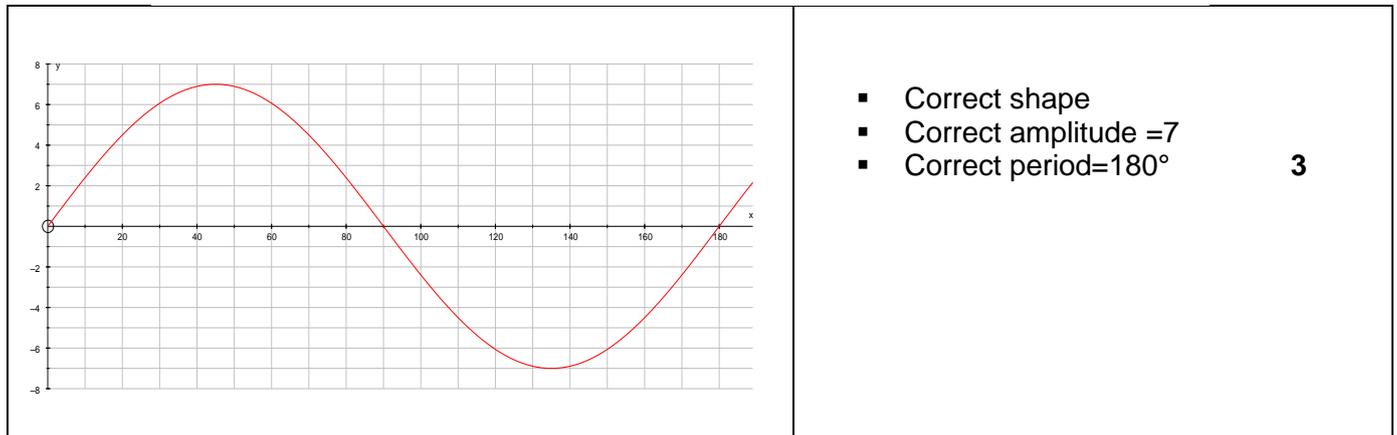
NOTES:

- (i) the second mark must involve the addition/subtraction of at least 2 areas

(b)	<p>Ans: 130 cm</p> <ul style="list-style-type: none"> • strategy • consistent units • solution 	<ul style="list-style-type: none"> • $V = 1200 \times l$ • $156\ 000 = 1200 \times l$ • 130 	3 RE
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NOTES:

- (i) consistent units (156 → 156000 or 1200 → 1.2) may occur at any stage
- (ii) candidates who use $l \times b \times h$ in part (b) may still be awarded the last 2 marks



12 a	Answer: 44.4 cm (1 d.p.) <ul style="list-style-type: none"> •¹ strategy for arc length •² calculation 	2	<ul style="list-style-type: none"> •¹ $\frac{82}{360} = \frac{BC}{2\pi \cdot 31}$ •² $\Rightarrow BC = 44.36662\dots$
b	Answer: radius = 7.06 ... cm <ul style="list-style-type: none"> •¹ establish link between arc and circumference •² get radius from circumference 	2	<ul style="list-style-type: none"> •¹ circumference = arc BC = 44.4 cm •² $R = 44.4 \div 2\pi = 7.06$
c	Answer: 30.2 cm (3 s.f.) <ul style="list-style-type: none"> •¹ establish link between rad of sector and slant height. •² use Pythagoras' theorem to find height •³ perform calculation 	3	<ul style="list-style-type: none"> •¹ we have right angled triangle: base = 7.06, hypotenuse = 31; height = h. •² $h = \sqrt{31^2 - 7.06^2}$ •³ = 30.2 cm (3 s.f.)
13 a	Answer: $a = 2$; $b = -1$ <ul style="list-style-type: none"> •¹ interpret chart (find amplitude) •² interpret chart (find vertical-displacement). 	2	<ul style="list-style-type: none"> •¹ Difference between max and min is 4. So amplitude = 2. $a = 2$. •² Max is at 1 instead of 2. So vertical displacement = -1. $b = -1$.

<ul style="list-style-type: none"> •¹ identify y intercept or evaluate 'c' in $y = mx + c$ •² find gradient •³ state equation of straight line 	<ul style="list-style-type: none"> •¹ 3 •² 2 •³ $y = 2x + 3$
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- Where m and/or c are incorrect, the working should be followed through to give the possibility of awarding 1/3 or 2/3.