

# X101/202

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NATIONAL  
QUALIFICATIONS  
2011

WEDNESDAY, 18 MAY  
1.00 PM – 1.45 PM

MATHEMATICS  
INTERMEDIATE 2  
Units 1, 2 and  
Applications of Mathematics  
Paper 1  
(Non-calculator)

**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. If you make use of this, you should write your name on it clearly and put it inside your answer booklet.



## FORMULAE LIST

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.

**ALL questions should be attempted.**

1. Sandi takes the bus to work each day.

Over a two week period, she records the number of minutes the bus is late each day. The results are shown below.

5    6    15    0    6    11    2    9    8    7

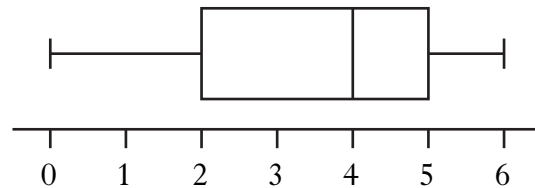
- (a) From the above data, find:

- (i) the median; 1  
(ii) the lower quartile; 1  
(iii) the upper quartile. 1

- (b) Construct a boxplot for the data. 2

Sandi decides to take the train over the next two week period and records the number of minutes the train is late each day.

The boxplot, drawn below, was constructed for the new data.



- (c) Compare the two boxplots and comment. 1

2. Factorise

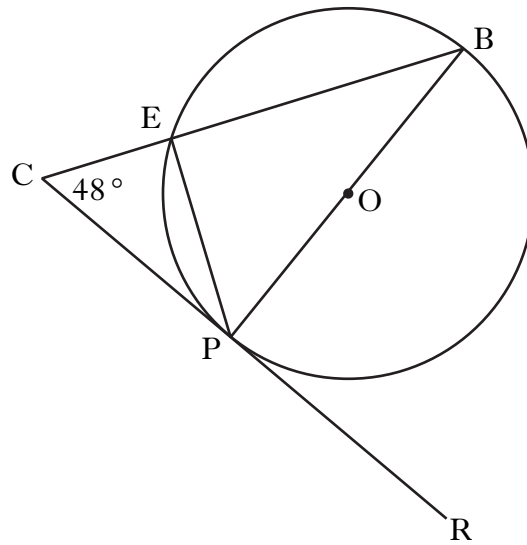
$$x^2 - 4x - 21. \quad \text{2}$$

3. Multiply out the brackets and collect like terms.

$$5x + (3x + 2)(2x - 7) \quad \text{3}$$

**[Turn over**

4. A circle, centre  $O$ , is shown below.



In the circle

- $PB$  is a diameter
- $CR$  is a tangent to the circle at point  $P$
- Angle  $BCP$  is  $48^\circ$ .

Calculate the size of angle  $EPR$ .

**3**

5. The approximate stopping distance of a car can be found by using the formula

$$D = \frac{1}{3} \left( S + \frac{S^2}{20} \right)$$

where  $D$  metres is the approximate stopping distance  
and  $S$  miles per hour is the speed before braking.

Calculate the approximate stopping distance when the speed before braking is 30 miles per hour.

**3**

6. Below is the summary part of Geetha's Credit Card statement at the end of May.

<b>Briggs Bank</b>	
<b>CREDIT CARD STATEMENT</b>	
Summary as at 21 May 2011	
Credit Limit	£4000
Available Credit	£3760
Balance from previous statement	£0.00
New Transactions	£240.00
Interest	£0.00
Balance owed	£240.00
Minimum payment due	£7.20
Payment due date	15 June 2011
Interest will be charged at 1% per month on any outstanding balance.	

Geetha pays the minimum payment.

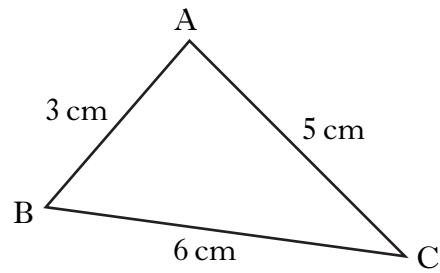
She does not use the credit card again.

What is the "Balance owed" in her next statement?

2

**[Turn over**

7.



In triangle ABC, show that  $\cos B = \frac{5}{9}$ .

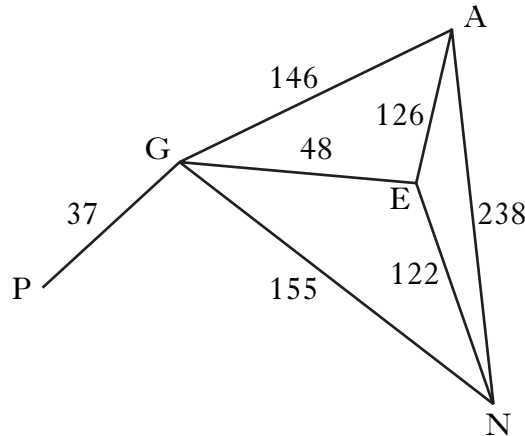
3

8. A straight line is represented by the equation  $y = mx + c$ .

Sketch a possible straight line graph to illustrate this equation when  $m > 0$  and  $c < 0$ .

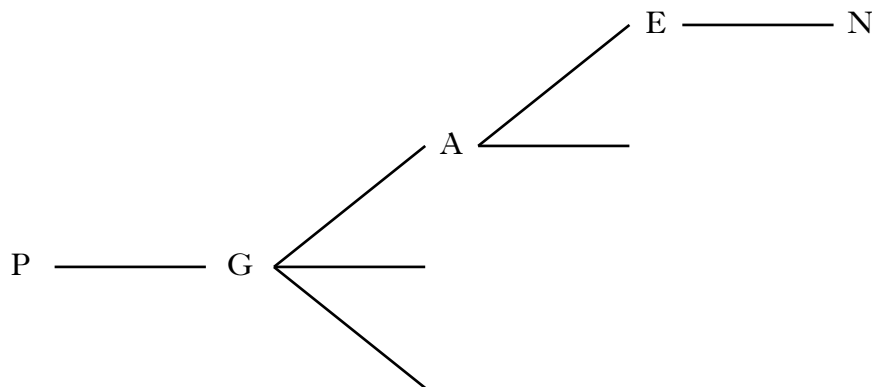
2

9. A catering company supplies the airports at Aberdeen (A), Edinburgh (E), Glasgow (G), Newcastle (N) and Prestwick (P). The network diagram below represents the distances in miles by road between the airports.



Catering supplies are distributed by van from Prestwick to the other airports. The van does not need to return to Prestwick.

- (a) Copy and complete the tree diagram to show **all** the possible routes the van can take.



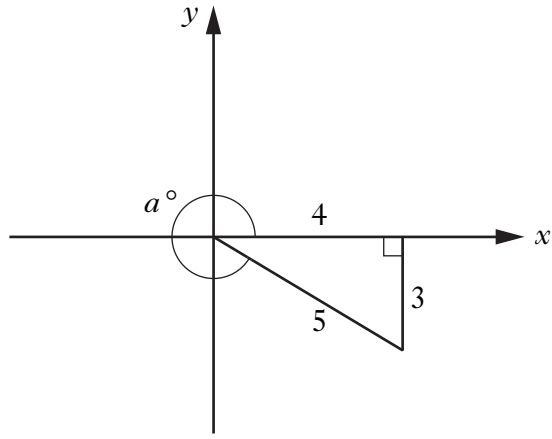
3

- (b) The van driver decides he wants to finish the journey at **Newcastle**.  
 What is the shortest distance he has to drive to finish the journey at Newcastle?  
 Explain your answer.

2

[Turn over for Question 10 on *Page eight*

10.



Write down the value of  $\cos a^\circ$ .

1

[END OF QUESTION PAPER]



# X101/204

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2.05 PM – 3.35 PM

MATHEMATICS  
INTERMEDIATE 2  
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Applications of Mathematics  
Paper 2

Read carefully

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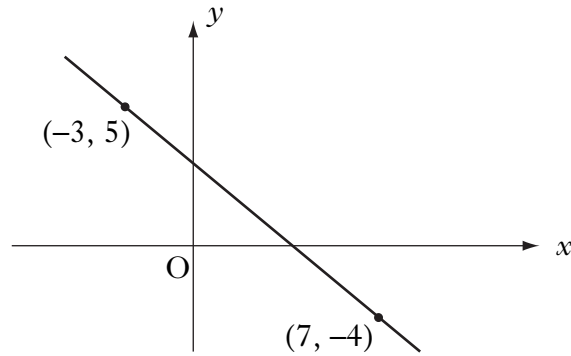
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**ALL questions should be attempted.**

1.



Calculate the gradient of the straight line passing through the points  $(-3, 5)$  and  $(7, -4)$ .

1

2. It is estimated that house prices will increase at the rate of  $3.15\%$  per annum.

A house is valued at  $\pounds 134\,750$ . If its value increases at the predicted rate, calculate its value after 3 years.

Give your answer correct to **four** significant figures.

4

3. The Battle of Largs in 1263 is commemorated by a monument known as The Pencil.

This monument is in the shape of a cylinder with a cone on top.



The cylinder part has diameter 3 metres and height 15 metres.

(a) Calculate the volume of the **cylinder** part of The Pencil.

2

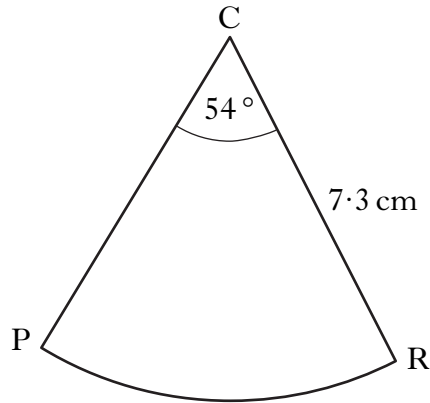
The volume of the **cone** part of The Pencil is  $5.7$  cubic metres.

(b) Calculate the **total** height of The Pencil.

3

**[Turn over**

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



The radius of the circle is 7.3 centimetres and angle PCR is 54°.

Calculate the area of the sector PCR.

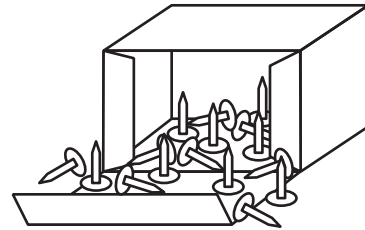
3

5. A sample of six boxes contains the following numbers of pins per box.

43    39    41    40    39    44

(a) For the above data, calculate:

- (i) the mean;
- (ii) the standard deviation.



1

3

The company which produces the pins claims that “the mean number of pins per box is  $40 \pm 2$  and the standard deviation is less than 3”.

(b) Does the data in part (a) support the claim made by the company?

Give reasons for your answer.

2

6. Alan is taking part in a quiz. He is awarded  $x$  points for each correct answer and  $y$  points for each wrong answer. During the quiz, Alan gets 24 questions correct and 6 wrong. He scores 60 points.

(a) Write down an equation in  $x$  and  $y$  which satisfies the above condition. 1

Helen also takes part in the quiz. She gets 20 questions correct and 10 wrong. She scores 40 points.

(b) Write down a second equation in  $x$  and  $y$  which satisfies this condition. 1

(c) Calculate the score for David who gets 17 correct and 13 wrong. 4

7. The table below gives the **monthly** repayments from three different banks on a £10 000 loan repaid over **five years**.

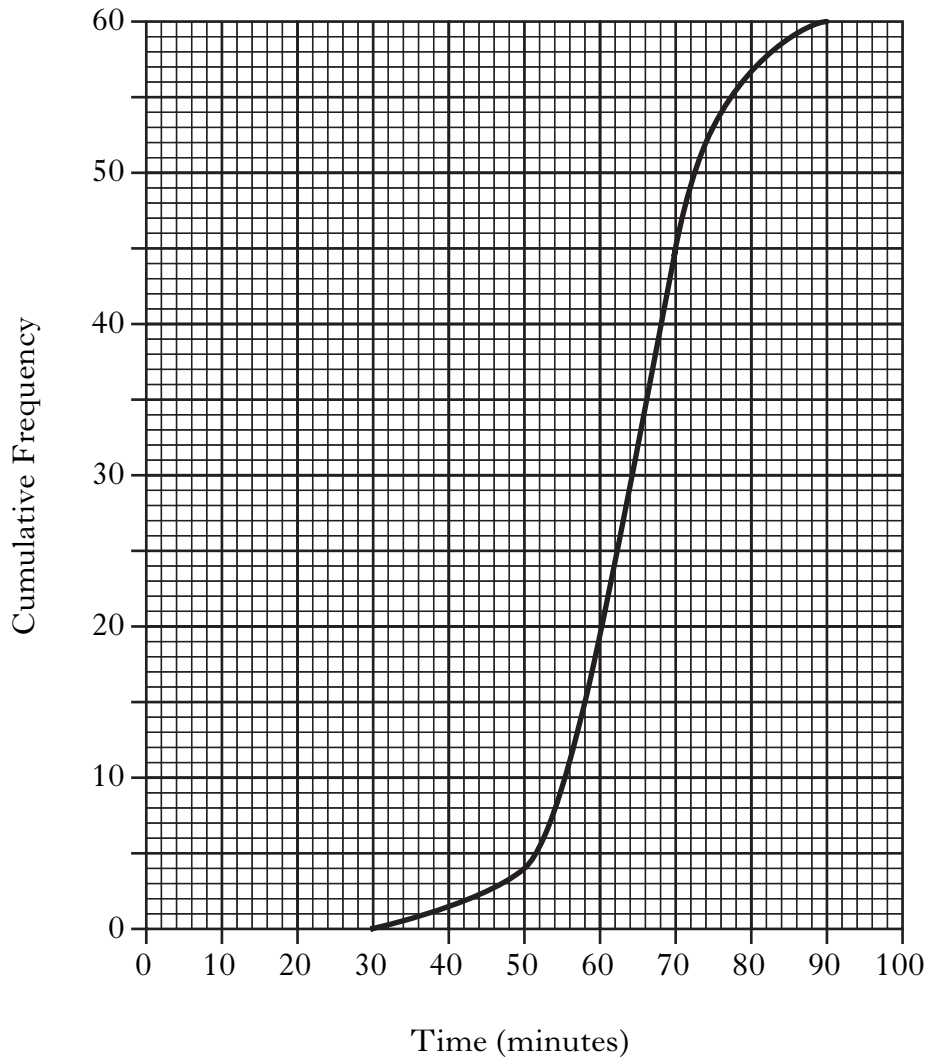
Name of Bank	Monthly Repayments	
	With payment protection	Without payment protection
Savewell	£245.39	£214.39
Finesave	£260.58	£205.65
Wisepend	£263.17	£214.70

Emily borrowed £10 000 and paid it back over five years. The cost of the loan was £2339. Which bank was the loan from and did she take it with or without payment protection?

3

**[Turn over**

8. In a race, organisers record how long each runner takes to complete the course. The results are shown in the cumulative frequency curve below.



- (a) How many runners completed the course in 50 minutes or less? **1**
- (b) Calculate the semi-interquartile range for the data represented in the diagram. **3**

9. Jack works a basic week of 35 hours.

Any overtime is paid at time and a half.

One week he works for 39 hours and is paid £255.84.

How much is he paid for each hour of **overtime** that he works?



3

[Turn over

10. Seamus has been offered jobs by both Paywell and Highpay. He constructs a spreadsheet to allow him to compare the salaries he has been offered. Part of the spreadsheet is shown below.

	A	B	C	D	E
1	<b>Paywell</b>				
2		<b>Basic salary</b>	<b>Bonus</b>	<b>Annual gross salary</b>	<b>Total earned to date</b>
3					
4	<b>Year 1</b>	£15,000	£1,250	£16,250	£16,250
5	<b>Year 2</b>	£15,600	£1,300	£16,900	£33,150
6	<b>Year 3</b>	£16,200	£1,350	£17,550	
7	<b>Year 4</b>	£16,800	£1,400		
8	<b>Year 5</b>	£17,400			
9					
10	<b>Highpay</b>				
11		<b>Basic salary</b>	<b>Bonus</b>	<b>Annual gross salary</b>	<b>Total earned to date</b>
12					
13	<b>Year 1</b>	£12,000	£1,200	£13,200	£13,200
14	<b>Year 2</b>	£14,000	£1,400	£15,400	£28,600
15	<b>Year 3</b>	£16,000	£1,600	£17,600	
16	<b>Year 4</b>	£18,000	£1,800		
17	<b>Year 5</b>	£20,000	£2,000		

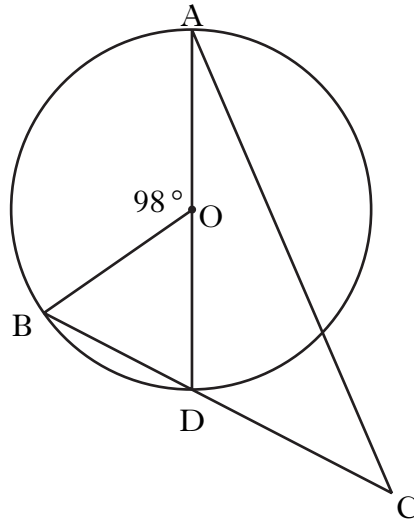
Paywell offers an initial basic salary of £15 000, with a rise of £600 per annum and a bonus of one month's salary.

Highpay offers an initial basic salary of £12 000, with a rise of £2000 per annum and a bonus of 10% of his annual salary.

- (a) Write down the **formula** to enter in cell C4 the bonus for Year 1. 1
- (b) Write down the **formula** to enter in cell E8 the total salary earned after 5 years with Paywell. 1
- (c) What will appear in cell E8? 2
- (d) Seamus intends to stay with the company for only 3 years.  
Which company will allow him to earn more money in that time? 2



11.



AD is a diameter of a circle, centre O.

B is a point on the circumference of the circle.

The chord BD is extended to a point C, outside the circle.

Angle BOA =  $98^\circ$ .

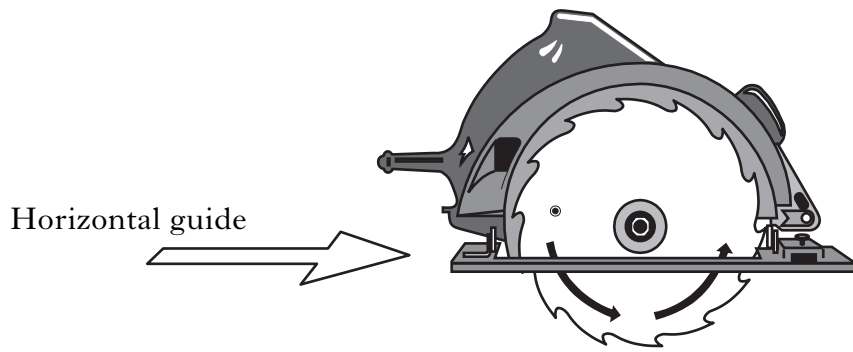
DC = 9 centimetres. The radius of the circle is 7 centimetres.

Calculate the length of AC.

5

[Turn over for Question 12 on Page ten

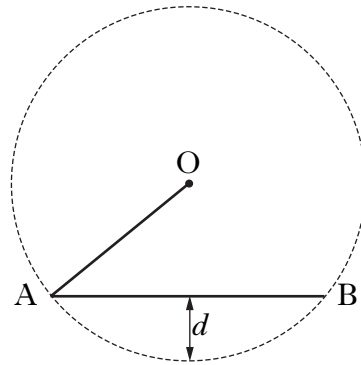
12. A circular saw can be adjusted to change the depth of blade that is exposed below the horizontal guide.



The circle, centre  $O$ , below represents the blade and the line  $AB$  represents part of the horizontal guide.

This blade has a radius of 110 millimetres.

If  $AB$  has length 140 millimetres, calculate the depth,  $d$  millimetres, of saw exposed.



4

[END OF QUESTION PAPER]

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