www.xtrapapers.com

OCR
RECOGNISING ACHIEVEMENT

Thursday 17 January 2013 – Afternoon

FSMQ INTERMEDIATE LEVEL

6989/01 Foundations of Advanced Mathematics (MEI)

Candidates answer on the Answer Sheet.

OCR supplied materials:
- Answer Sheet (MS4)

Other materials required:
- Eraser
- Scientific calculator
- Soft pencil
- Ruler

Duration: 2 hours

* 6 9 8 9 0 1 *

* 6 9 8 9 0 1 6 2 8 0 1 3 *

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your centre number and candidate number on the Answer Sheet in the spaces provided unless this has already been done for you.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Do **not** write in the bar codes.
- There are **forty** questions in this paper. Attempt as many questions as possible. For each question there are four possible answers, **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.
- **Read very carefully the instructions on the Answer Sheet.**

INFORMATION FOR CANDIDATES

- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- This document consists of **24** pages. Any blank pages are indicated.

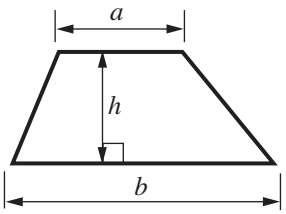
© OCR 2013 [100/2604/6]
DC (AC/SW) 61526/3

OCR is an exempt Charity

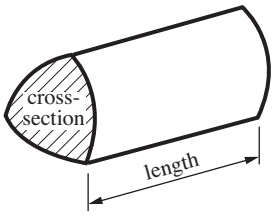
www.xtrapapers.com

Formulae Sheet: 6989 Foundations of Advanced Mathematics

Area of trapezium = $\frac{1}{2}(a + b)h$



Volume of prism = (area of cross-section) × length

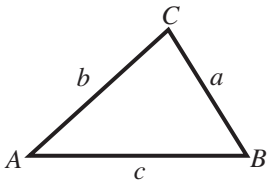


In any triangle ABC

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

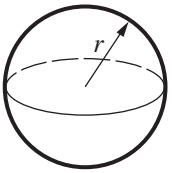
Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

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



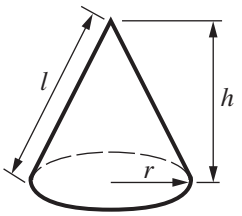
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$



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

Curved surface area of cone = $\pi r l$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$,
where $a \neq 0$, are given by

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

© OCR 2013

www.xtrapapers.com

1 Three of the following statements are true and **one** is false. Which one is **false**?

A The cube of 9 is 729.

B The highest common factor (HCF) of 24 and 36 is 6.

C The lowest common multiple (LCM) of 24 and 36 is 72.

D The reciprocal of 0.5 is 2.

2 Three of the following statements are true and **one** is false. Which one is **false**?

A $45\% = \frac{9}{20}$

B The recurring decimal 0.27272727… is equal to $\frac{3}{11}$.

C 512:64 = 8:1

D $2^{-2} = \frac{1}{2}$

www.xtrapapers.com

3 The incomplete table shows information about the membership of a tennis club.

	Male	**Female**	**Total**
Senior	41		80
Junior		21	
Total			120

In order to answer the question you are advised to complete the table.

Three of the following statements are true and **one** is false. Which one is **false**?

A A member is chosen at random. The probability of choosing a senior member is $\frac{2}{3}$.

B The number of junior males is 19.

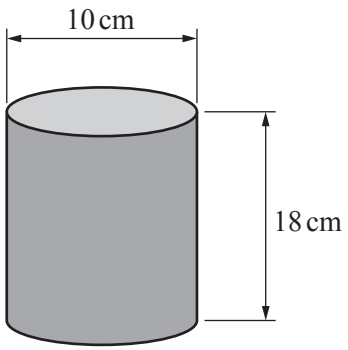
C 40% of the members are male.

D A member is chosen at random. The probability of not choosing a female senior member is $\frac{27}{40}$.

© OCR 2013

www.xtrapapers.com

4 An open-top cylindrical pencil case has a diameter of 10 cm and a height of 18 cm.



Three of the following statements are true and **one** is false. Which one is **false**?

A A thin pencil of length 20 cm can fit completely into the pencil case.

B The volume of the pencil case is 1400 cm^3, correct to 2 significant figures.

C The curved surface area of the pencil case is 565 cm^2, correct to 3 significant figures.

D The area of the cross-section of the pencil case is 314 cm^2, correct to the nearest whole number.

© OCR 2013

www.xtrapapers.com

5 Which **one** of the following is the **correct** solution of $4(x-1) > 2x+3$?

A $x < \frac{7}{2}$

B $x > 2$

C $x > \frac{7}{2}$

D $x < 2$

6 Three of the following statements are true and **one** is false. Which one is **false**?

A $\frac{1}{6} + \frac{3}{4} = \frac{11}{12}$

B $4 \div \frac{3}{16} = 21\frac{1}{3}$

C $3\frac{1}{3} \times 1\frac{1}{4} = 4\frac{1}{12}$

D $\frac{11}{12} - \frac{1}{3} = \frac{7}{12}$

© OCR 2013

www.xtrapapers.com

7 Here are some data relating to the land area of four countries in square kilometres.

Russia	17 098 242 km^2
Columbia	1 141 748 km^2
United Kingdom	242 900 km^2
Solomon Islands	28 896 km^2

Three of the following statements are true and **one** is false. Which one is **false**?

A The land area of the United Kingdom is $2.43 \times 10^6 km^2$, correct to 3 significant figures.

B To obtain a rough estimate of the ratio of the land areas of Russia to Columbia, the areas are corrected to the nearest million km^2. The ratio is then found to be 17:1.

C The land area of the Solomon Islands will fit into the land area of Colombia between 39 and 40 times.

D The land area of the United Kingdom is 21.3% of the land area of Colombia, correct to 1 decimal place.

8 Which **one** of the following is the **correct** simplification of $\frac{4x+1}{6} - \frac{2x-3}{4}$?

A $\frac{2x-7}{12}$

B $x-1$

C $\frac{2x+11}{12}$

D $x+2$

© OCR 2013

www.xtrapapers.com

9 Three of the following statements are true and **one** is false. Which one is **false**?

A The solution of $3x + 14 = 11$ is $x = -1$.

B The solution of $\frac{5x}{2} = 6$ is $x = 2\frac{2}{5}$.

C The solution of $\frac{3}{x} = 10$ is $x = \frac{10}{3}$.

D The solution of $3x + 2(x - 1) = 5$ is $x = 1\frac{2}{5}$.

10 Mia has a recipe for spaghetti bolognese for 3 people. The ingredients are as follows.

$\frac{1}{2}$ lb beef mince
1 onion
3 mushrooms
400 g chopped tomatoes
5 tablespoons tomato puree
1 lb spaghetti

Measurements
1 tablespoon = 15 millilitres
1 lb = 450 g

Three of the following statements are true and **one** is false. Which one is **false**?

A To make spaghetti bolognese for 8 people, Mia would need to use 600 g of beef mince.

B 5 tablespoons of tomato puree is equivalent to 0.075 litres.

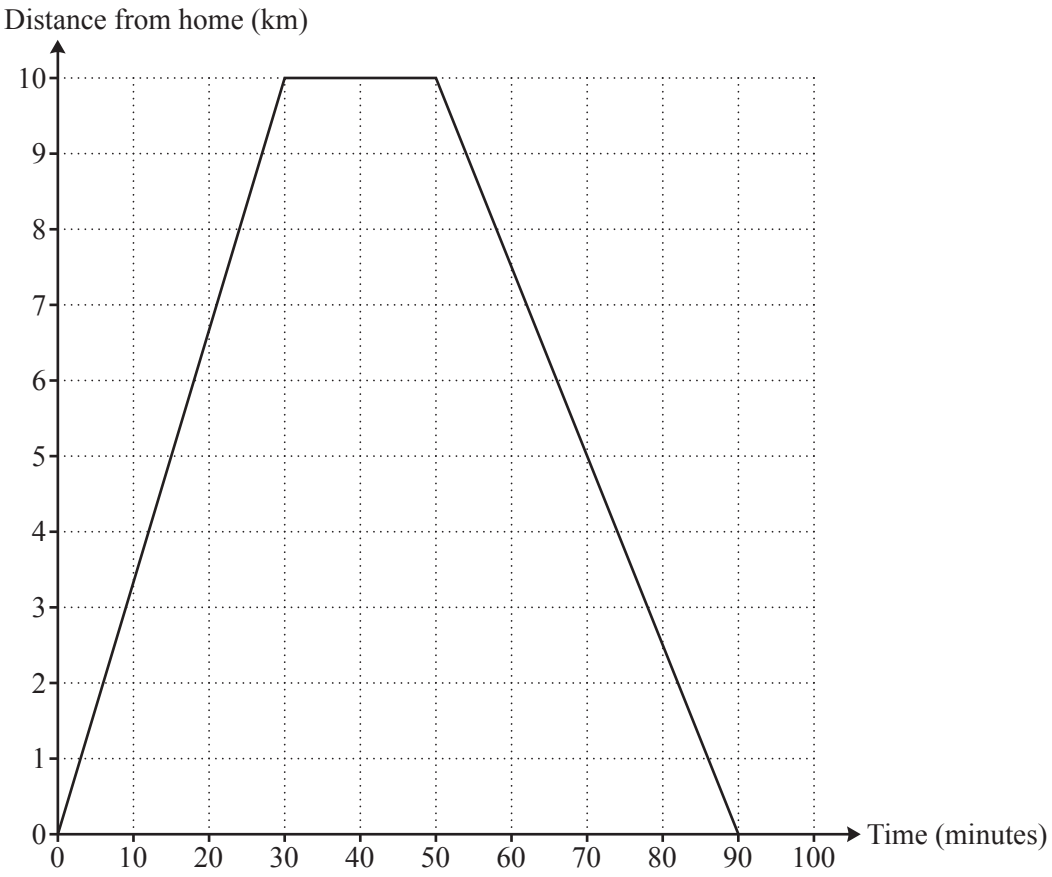
C To make spaghetti bolognese for 8 people, Mia would need 24 mushrooms.

D To make spaghetti bolognese for 12 people, Mia would need 1800 g of spaghetti.

© OCR 2013

www.xtrapapers.com

11 The diagram below illustrates Nina's bicycle journey.



Three of the following statements are true and **one** is false. Which one is **false**?

A Nina's speed during the first 30 minutes is $20\,\text{km}\,\text{h}^{-1}$.

B The total distance Nina travels is 10 km.

C Nina is stationary for 20 minutes.

D Nina's speed during the last 40 minutes is $15\,\text{km}\,\text{h}^{-1}$.

12 Three of the following statements are true and **one** is false. Which one is **false**?

A $5 + 3 \times 2 = 16$

B $16 \div 2^{-3} = 2^7$

C $\dfrac{4-5}{2^3-3^2} = 1$

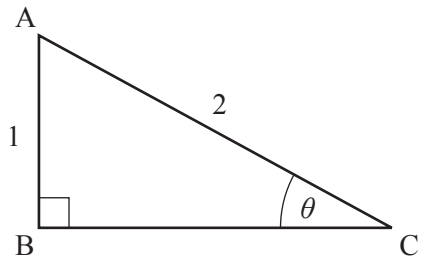
D $4^3 + 4^6 - 4^7 = -12\,224$

www.xtrapapers.com

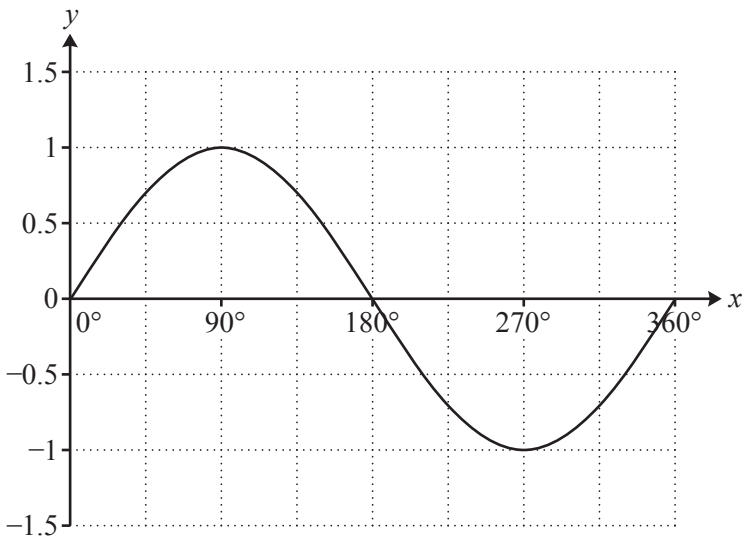
13 Three of the following statements are true and **one** is false. Which statement is **false**?

A $\tan 43° = \tan 223°$

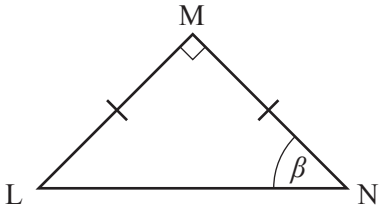
B In triangle ABC, $\sin\theta = 0.5$.



C The diagram below is part of the curve $y = \cos x$.



D In the isosceles triangle LMN, $\tan\beta = 1$.



www.xtrapapers.com

14 Three of the following points lie on the curve $y = x^3 + 2x^2 - 3x - 4$ and **one** does not. Which one does **not**?

A $(-4, -24)$

B $(4, 32)$

C $(-2, 2)$

D $(0, -4)$

15 Three of the following statements are true and **one** is false. Which one is **false**?

A $y = 2x + 5$ may be rearranged to give $x = \dfrac{y - 5}{2}$.

B $v^2 = u^2 + 2as$ may be rearranged to give $u = \pm\sqrt{v^2 - 2as}$.

C $I = PRT$ may be rearranged to give $T = \dfrac{I}{PR}$.

D $M = \sqrt{\dfrac{4R}{T}}$ may be rearranged to give $R = \dfrac{M^2T}{16}$.

© OCR 2013

www.xtrapapers.com

16 A plumber charges a £50 call-out fee, and then £22 for every 30 minutes of work. The total cost of call-out involving T hours of work by the plumber is £C.

Which **one** of the following is a **correct** formula for C?

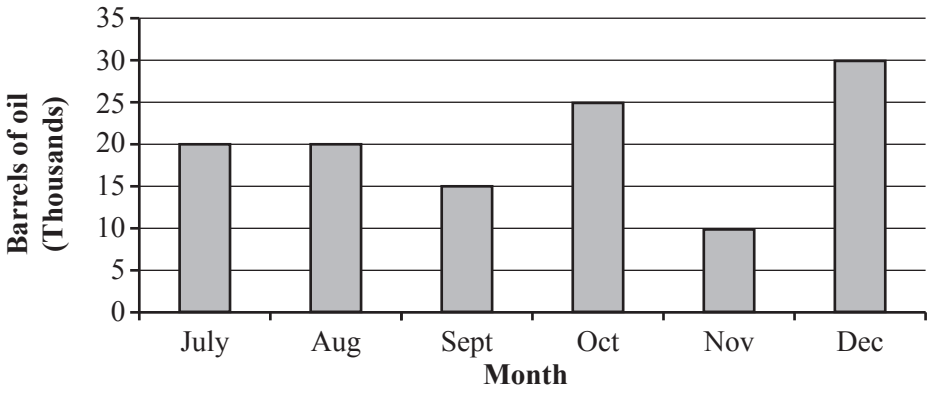
A $C = 50T + 22$

B $C = 22T + 50$

C $C = 44T + 50$

D $C = 50T + 44$

17 The chart below shows the quantity of barrels of oil extracted from a well during the second half of 2010.



Three of the following statements are true and **one** is false. Which one is **false**?

A There was 25% less oil extracted in September than in August.

B The total quantity of oil extracted during the six month period was 120 000 barrels.

C The quantity of oil extracted in December was 200% of the quantity of oil extracted in September.

D More oil was extracted in November and December than in any other period of two consecutive months.

© OCR 2013

www.xtrapapers.com

18 A wooden door is 2000 mm high and 900 mm wide, both correct to the nearest 5 mm.

Three of the following statements are true and **one** is false. Which one is **false**?

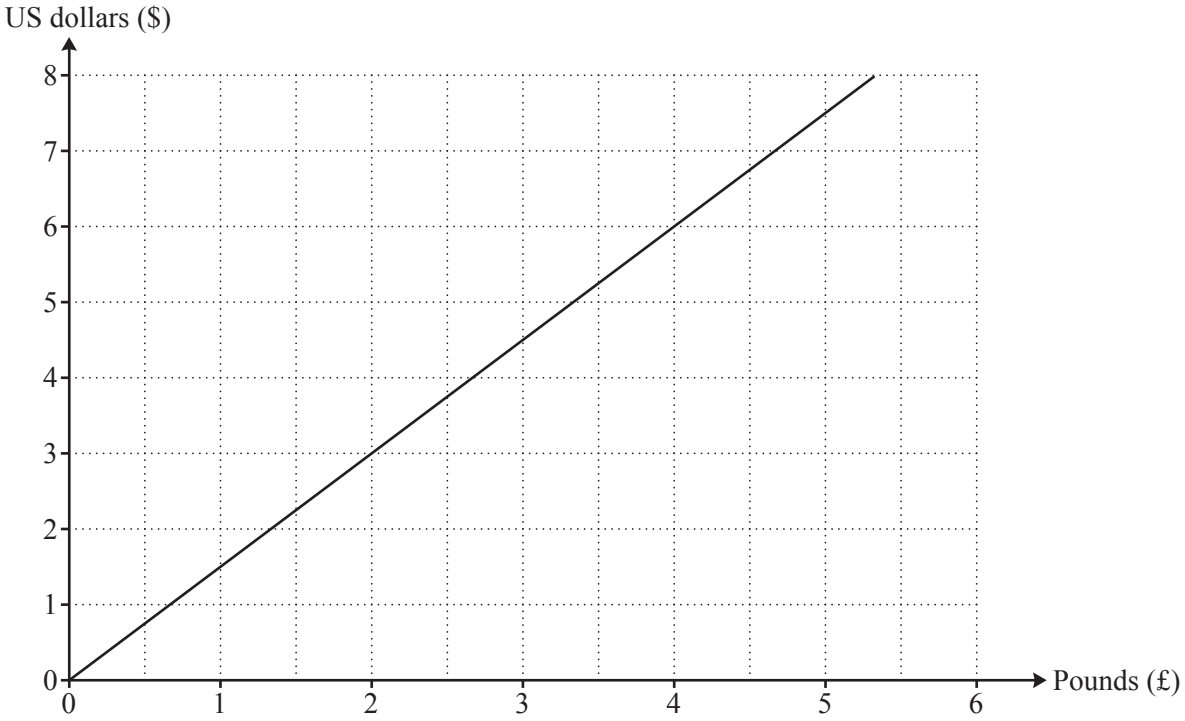
A The upper bound of the height of the door is 2025 mm.

B The lower bound of the width of the door is 0.8975 m.

C The lower bound of the area of the door is 1.793 m^2, correct to 3 decimal places.

D The upper bound of the area of the door is 1.807 m^2, correct to 3 decimal places.

19 On one day the exchange rate from US dollars ($) to pounds (£) is $1.52 to £1.00. The graph below represents the conversion between pounds sterling and dollars at that rate.



Three of the following statements are true and **one** is false. Which one is **false**?

A £200 is equivalent to $304.

B $4500 is equivalent to £2960.53, correct to the nearest penny.

C The US dollar is equivalent to 66p, correct to the nearest penny.

D On another day the exchange rate was equivalent to $1 = 52p. The gradient of the conversion graph would be less steep than that drawn above.

© OCR 2013

www.xtrapapers.com

20 Which **one** of the following is the **correct** value of x in the solution of the following simultaneous equations?

$$4x - 3y = 19$$
$$2x + y = 2$$

A $x = 4$

B $x = -3$

C $x = -5$

D $x = 2\frac{1}{2}$

21 Three of the following statements are true and **one** is false. Which one is **false**?

A $x^2 - 2x - 15 = (x + 3)(x - 5)$

B $9x^2 - 16 = (3x - 4)(3x + 4)$

C $x^2 - 10x = (x - 5)(x + 2)$

D The solution of $x^2 - 2x - 3 = 0$ is $x = 3$ or $x = -1$.

© OCR 2013

www.xtrapapers.com

22 You are given the vectors $\mathbf{a} = 4\mathbf{i} + 3\mathbf{j}$, $\mathbf{b} = 5\mathbf{i} + \mathbf{j}$ and $\mathbf{c} = \mathbf{i} - 2\mathbf{j}$.

Three of the following statements are true and **one** is false. Which one is **false**?

A The magnitude of $\mathbf{a}$ is 5 units.

B The vector $15\mathbf{i} - 3\mathbf{j}$ is in the same direction as $\mathbf{b}$.

C $\mathbf{c} = \mathbf{b} - \mathbf{a}$

D $2\mathbf{a} - \mathbf{c} = 7\mathbf{i} + 8\mathbf{j}$

23 Three of the following statements are reasonable and **one** is not. Which one is **not** reasonable?

A The mass of an apple is 1800 g.

B The volume of a bottle of wine is 75 centilitres.

C The length of a pencil is 7 inches.

D The mass of a family car is 1200 kg.

© OCR 2013

www.xtrapapers.com

24 A printing press involves three separate machines A, B, and C printing the colours black, blue and red respectively on documents. The machines are not reliable and sometimes fail to print a colour. The probability of printing black correctly (machine A) is 0.95, blue (machine B) is 0.9 and red (machine C) is 0.85.
These probabilities are independent.

Three of the following statements are true and **one** is false. Which one is **false**?

A The probability of printing a document with all three colours present is 0.72675.

B The probability of printing a document that is completely blank is 0.27325.

C The probability of printing a document with red and black, but with the colour blue missing, is 0.08075.

D If machine A fails to print black, the probability of machine B failing to print blue is 0.1.

25 Which **one** of the following is the **correct** solution, to 3 significant figures, of

$$2x^2 + 3x - 6 = 0?$$

A $x = 1.14$ or -2.64

B $x = 1.14$ or -4.89

C $x = -1.11$ or -2.64

D $x = -1.11$ or -4.89

© OCR 2013

www.xtrapapers.com

26 Three of the following statements are true and **one** is false. Which one is **false**?

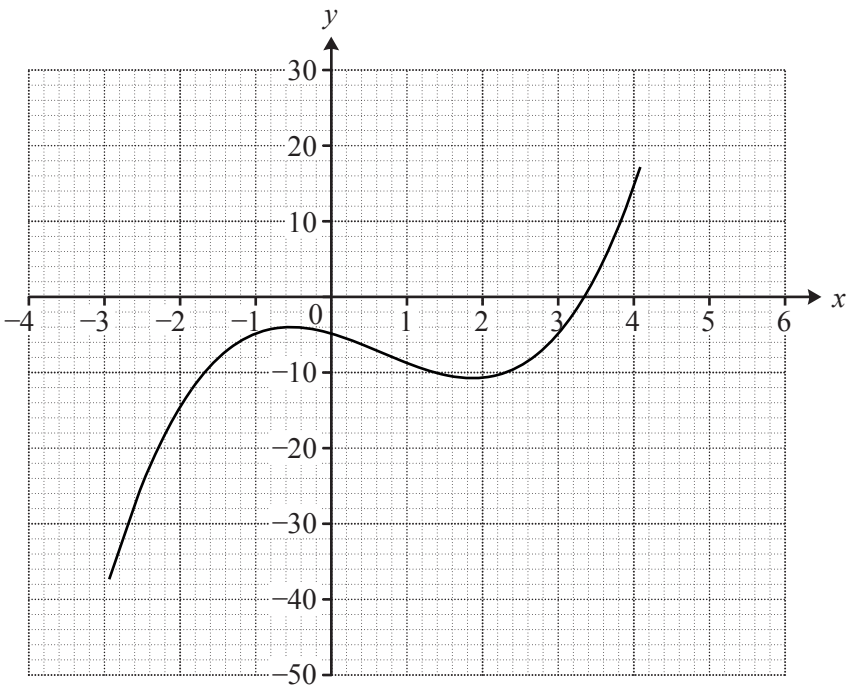
A $2(3x + 4) - 4(x - 1) = 2x + 4$

B The 20th term of the sequence 2, 5, 8, 11, 14, … is 59.

C The nth term of the sequence −1, 0, 3, 8, 15, ... is $n^2 - 2n$.

D One of the roots of the equation $2x^2 - 5x - 3 = 0$ is $x = -\frac{1}{2}$.

27 The diagram below shows part of the graph of $y = x^3 - 2x^2 - 3x - 5$.



Three of the following statements are true and **one** is false. Which one is **false**?

A The equation $x^3 - 2x^2 - 3x - 5 = 0$ has a root between 3 and 4.

B When $x = 0$ the gradient of the curve is negative.

C The equation $x^3 - 2x^2 - 3x - 5 = 0$ has exactly three roots.

D The curve $y = x^3 - 2x^2 - 3x - 5$ has two points where the gradient is zero.

© OCR 2013

www.xtrapapers.com

28 140 students were given a test marked out of 120 before a mathematics examination. They were then split into two groups of 70. Group A were given a self-study package, and group B attended a short intensive course. Both groups then sat the examination, again marked out of 120. The following table illustrates the results before and after the examination for the self-study group, and the group who attended the short intensive course.

	Lowest Mark	**Lower Quartile**	**Median**	**Upper Quartile**	**Highest Mark**
Group A – before self-study	30	48	55	71	80
Group A – after self-study	35	51	65	74	91
Group B – before short intensive course	28	47	54	70	75
Group B – after short intensive course	50	56	68	78	97

Three of the following statements are true and **one** is false. Which one is **false**?

A There was a 10 mark improvement in the median mark in group A from the test to the examination.

B The range of marks in group B, before and after the short intensive course, remained the same.

C After the short intensive course, one quarter of the students in group B scored between 56 and 78 marks inclusive.

D The short intensive course produced greater improvement than the self-study package.

© OCR 2013

www.xtrapapers.com

29 In the pyramid below, ACB, ACD and BCD are all right-angled triangles.

AB = BD = 10 cm
AC = CD = 6 cm

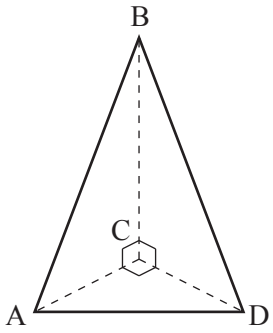
Three of the following statements are true and **one** is false. Which one is **false**?

A Length BC = 8 cm

B Angle ADC = 45°

C Length AD = $6\sqrt{3}$ cm

D cos BAC = $\frac{3}{5}$



30 A straight line has a gradient of $-\frac{3}{2}$ and an intercept of 4 on the y-axis.

Which **one** of the following is a **correct** equation of the line?

A $y = 4x - \frac{3}{2}$

B $3x + 2y - 8 = 0$

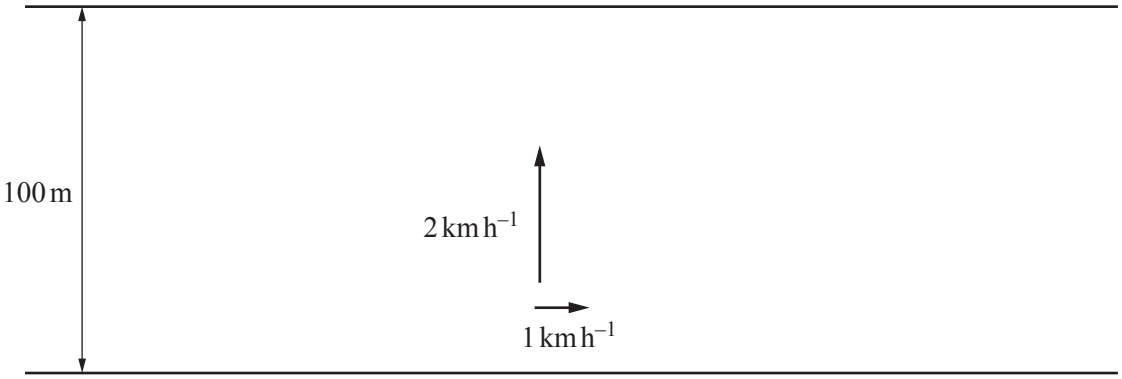
C $-2x + 3y + 4 = 0$

D $y = \frac{3}{2}x + 4$

© OCR 2013

www.xtrapapers.com

31 Andrew rows a small boat at a constant speed of $2\,\text{km}\,\text{h}^{-1}$ heading due north directly across a river. The river flows from west to east at $1\,\text{km}\,\text{h}^{-1}$. The river is 100 m wide.



Three of the following statements are true and **one** is false. Which one is **false**?

A Andrew's actual direction of travel is on a bearing of 027°, correct to the nearest degree.

B The total distance that Andrew travels from bank to bank is 110 m, correct to the nearest 10 m.

C The time taken by Andrew to row across the river is 50 minutes.

D If Andrew actually wants to travel due north, he must steer his boat on a bearing of 330°.

32 Three of the following statements are correct and **one** is false. Which one is **false**?

A 0.000 340 6 is equivalent to 3.4×10^{-3}, correct to 2 significant figures.

B An estimate of $\dfrac{23.651 \times 0.495}{11.243}$ is 1, correct to the nearest whole number.

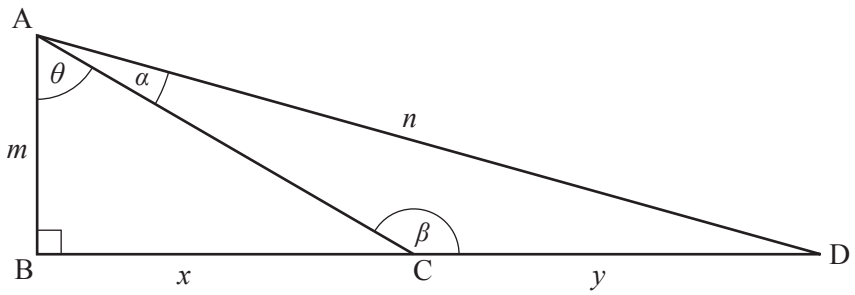
C $375\,000\,000 = 3.75 \times 10^{8}$

D $\left(2 \times 10^{13}\right) \div \left(8 \times 10^{6}\right) = 2.5 \times 10^{6}$

© OCR 2013

www.xtrapapers.com

33



Three of the following statements about the diagram are true and **one** is false. Which one is **false**?

A $\tan\theta = \frac{x}{m}$

B $n^2 = m^2 + x^2 + y^2$

C $\cos(\theta + \alpha) = \frac{m}{n}$

D $\beta = 90° + \theta$

34 Lisa collected data about the colours of cars in a car park.

Colour	Frequency
Red	61
Black	74
Silver	46
Blue	24
White	35

Three of the following statements are true and **one** is false. Which one is **false**?

A Lisa illustrates her data using a pie chart. The angle for the smallest sector is 36°.

B The fraction of white cars is $\frac{7}{48}$.

C When a car is chosen at random, the probability that it is not blue is 0.9.

D The ratio of blue cars to silver cars is 23:12.

© OCR 2013

www.xtrapapers.com

35 The table below shows the ages of people using a bowling alley.

Ages	Frequency
$0 < x \leqslant 10$	3
$10 < x \leqslant 15$	7
$15 < x \leqslant 20$	13
$20 < x \leqslant 30$	20
$30 < x \leqslant 40$	5
$40 < x \leqslant 50$	2

Three of the following statements are correct and **one** is false. Which one is **false**?

A There are 13 people up to the age of 20 years.

B The median age is between 20 and 30 years.

C The range is greater than 30 years.

D 14% of the people in the survey were aged over 30 years.

36 Here is a list of eight numbers.

4, 7, 11, 4, 8, 4, 5, 8

Which **one** of the following statements is **true**?

A mode < mean < median

B mode > median

C The mean is a whole number.

D The median and mean are equal, correct to the nearest whole number.

© OCR 2013

www.xtrapapers.com

37 The range of five numbers is 12. The numbers are all different and their median is 10. Two of the numbers are 19 and 8.

Which **one** of the following statements is **true**?

A The five numbers could be 7, 8, 8, 10, 19.

B The five numbers could be 7, 8, 10, 11, 19.

C The five numbers could be 8, 10, 12, 19, 20.

D The five numbers could be 7, 8, 10, 12, 20.

38 There are 800 pupils in a mixed school. The School Council has proposed changing the timings of the school day. In order to find out the views of the student population, they decide to take a random sample of 80 students.

Which **one** of the following will produce a **random** sample representing the whole school?

A Give a questionnaire to the first 80 students arriving at school one day and ask them to complete it before registration.

B Pick the names of 40 boys and 40 girls in Year 7 out of a hat and interview them, as they will be affected for the longest time by any changes.

C Assign a number to every student and chose 80 students for interview by using a random number generator on a calculator to pick out 80 numbers.

D Give out questionnaires to every student to complete in a form period, and use the first 80 that are returned.

© OCR 2013

www.xtrapapers.com

39 Three of the following statements are correct and **one** is false. Which one is **false**?

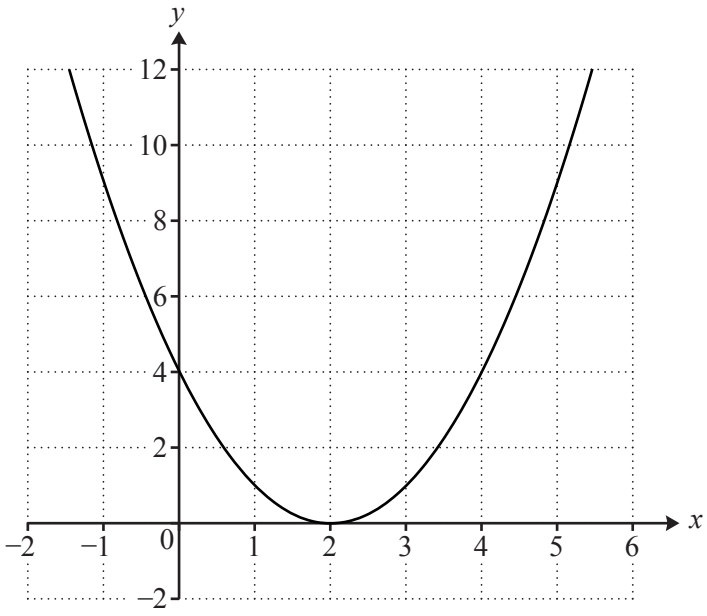
A $\dfrac{x^7 \times x^3}{x^5} = x^5$

B $\dfrac{y^{-4}}{y^{-7}} = y^{-3}$

C $x^0 = 1$

D $\left(x^3\right)^4 = x^{12}$

40 Which **one** of the following is the **correct** equation of the curve shown?



A $y = x^2 + 4$

B $y = 4 - x^2$

C $y = (x + 2)^2$

D $y = (x - 2)^2$

OCR
RECOGNISING ACHIEVEMENT

Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© OCR 2013