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**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
MATHEMATICS B (MEI)**

**B294B**

Paper 4 Section B (Higher Tier)

Candidates answer on the question paper.

**OCR supplied materials:**  
None

**Other materials required:**

- Geometrical instruments
- Scientific or graphical calculator
- Tracing paper (optional)

**Friday 14 January 2011  
Morning**

**Duration: 1 hour**



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**INSTRUCTIONS TO CANDIDATES**

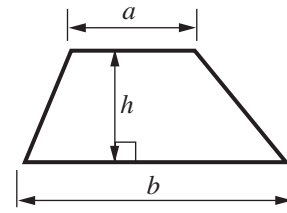
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Show your working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Answer **all** the questions.
- Do **not** write in the bar codes.

**INFORMATION FOR CANDIDATES**

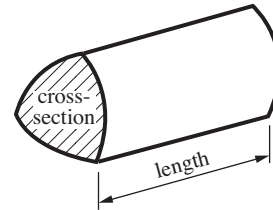
- The number of marks is given in brackets [ ] at the end of each question or part question.
- Section B starts with question 11.
- You are expected to use a calculator in Section B of this paper.
- Use the  $\pi$  button on your calculator or take  $\pi$  to be 3.142 unless the question says otherwise.
- The total number of marks for this Section is **50**.
- This document consists of **12** pages. Any blank pages are indicated.

## Formulae Sheet: Higher Tier

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



**Volume of prism** = (area of cross-section)  $\times$  length

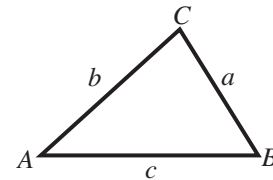


**In any triangle  $ABC$**

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

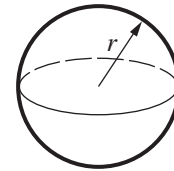
**Cosine rule**  $a^2 = b^2 + c^2 - 2bc \cos A$

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



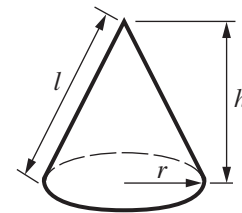
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

**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**

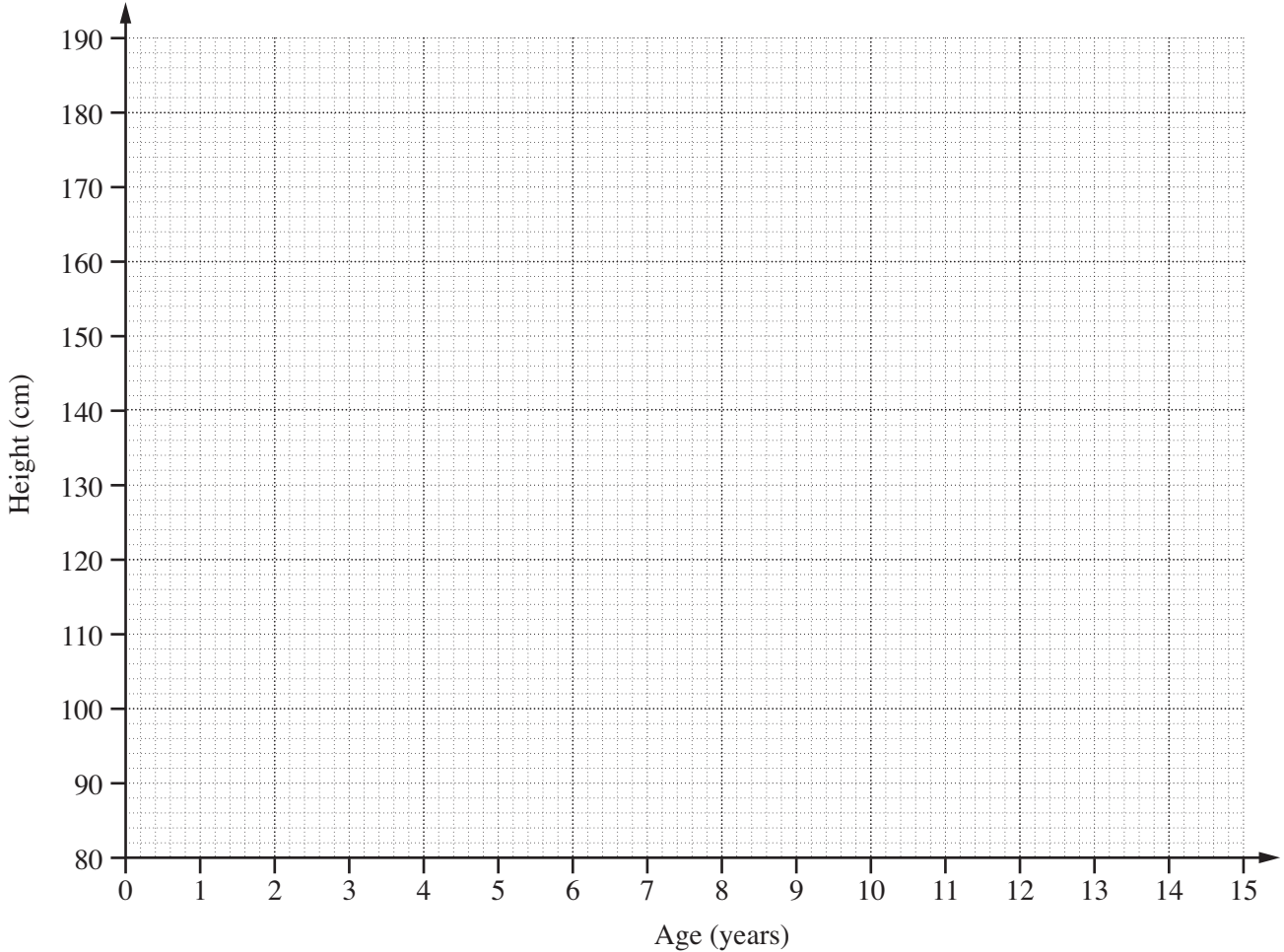
The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by

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

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11 The table shows the average heights of children of different ages in a certain town.

Age (years)	2	3	4	6	8	10
Height (cm)	86	95	102	116	128	139



(a) Plot the scatter diagram for these data. [2]

(b) Draw a line of best fit. [1]

(c) Use your line of best fit to estimate the average height of children from the town who are 7 years old.

(c) ..... cm [1]

(d) Would it be sensible to use your line of best fit to estimate the average height of children from the town who are 15 years old?  
Explain your answer.

..... because .....

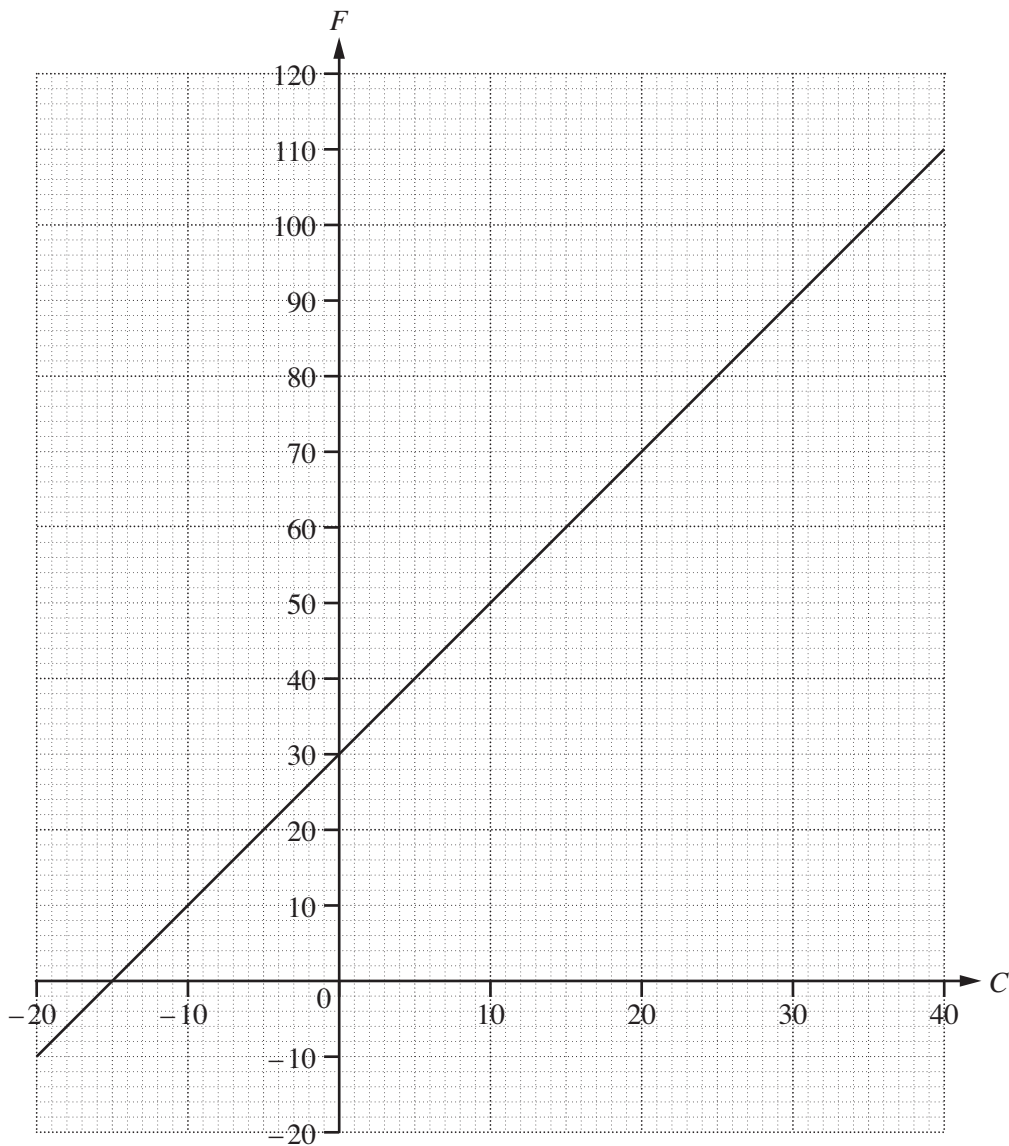
..... [1]

- 12 (a) Craig uses the formula  $F = 2C + 30$  to convert a temperature in degrees Celsius,  $C$ , to one in degrees Fahrenheit,  $F$ .

Use Craig's formula to find  $F$  when  $C = -35$ .

(a) ..... [1]

The conversion graph for Craig's formula is shown on the grid.



- (b) Craig's formula does not give exact conversions.  
The formula which gives exact conversions is

$$F = 1.8C + 32.$$

- (i) Complete this table for  $F = 1.8C + 32$ .

$C$	- 20	0	20	40
$F$			68	

[1]

- (ii) On the grid, draw the graph of  $F = 1.8C + 32$ .

[2]

- (c) At what temperature in degrees Celsius do both formulae give the same temperature in degrees Fahrenheit?

(c) ..... °C [1]

- 13 (a) Solve  $7x = 2x + 9$ .

(a) ..... [2]

- (b) Expand  $3x(x^2 - 5)$ .

(b) ..... [2]

14 In 2008 the rate of Value Added Tax (VAT) was reduced from 17.5% to 15%.

(a) A washing machine cost £320 **plus** VAT.

By how much was the selling price reduced?

(a) £ ..... [3]

(b) After the change to 15% VAT, the new selling price of a television was £632.50.

Calculate the selling price of the television before the change, when VAT was 17.5%.

(b) £ ..... [5]

15 These are the first six terms of a sequence.

3 5 7 9 11 13

(a) Write down an expression for the  $n$ th term of the sequence.

(a) ..... [2]

(b) (i) Hence write down an expression for the  $n$ th term of this sequence.

$\frac{1}{3}$   $\frac{1}{5}$   $\frac{1}{7}$   $\frac{1}{9}$   $\frac{1}{11}$   $\frac{1}{13}$  ..... ..

(b)(i) ..... [1]

(ii) Explain why the  $(n + 1)$ th term of the sequence in (b)(i) is  $\frac{1}{2n + 3}$ .

.....  
 ..... [1]

(iii) Find as a single fraction, in its simplest form,

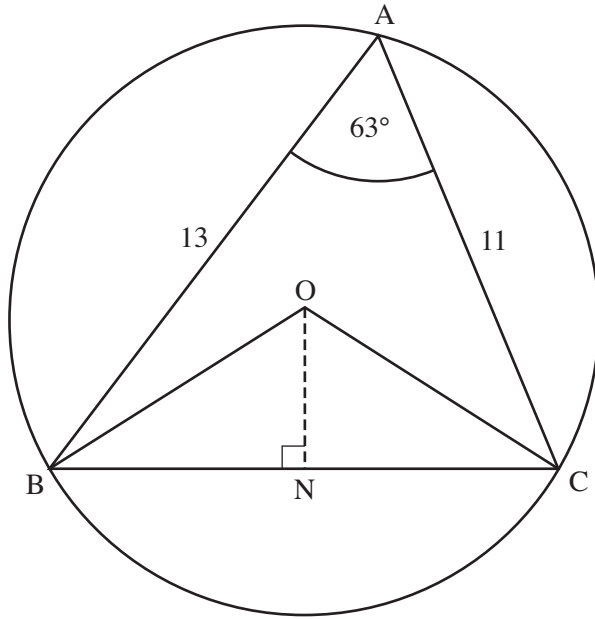
$$\frac{1}{2n + 1} - \frac{1}{2n + 3}$$

(iii) ..... [3]

(iv) Use your answer to part (b)(iii) to find the difference between the 25th and 26th term of the sequence

$\frac{1}{3}$   $\frac{1}{5}$   $\frac{1}{7}$   $\frac{1}{9}$   $\frac{1}{11}$   $\frac{1}{13}$  ..... ..

(iv) ..... [1]



Not to scale

A, B and C are points on the circle, centre O. ON is perpendicular to BC. AB = 13 cm, AC = 11 cm and angle BAC = 63°.

(a) Show that BC = 12.66 cm correct to 2 decimal places.

.....

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.....

.....

..... [2]

(b) Explain why angle BON = 63°.

.....

..... [2]

(c) Calculate OB, the radius of the circle.

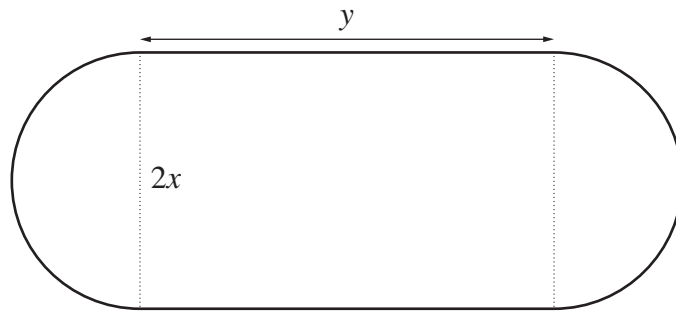
(c) ..... cm [4]



(d) Calculate the area of the **sector** BOC.

(d) .....cm<sup>2</sup> [3]

- 17 In this question use 3 as an approximation to  $\pi$ .  
All the lengths are in centimetres.



The shape above is made up of a rectangle and two semicircles.  
The radius of each semicircle is  $x$  and the length of the rectangle is  $y$ .

The total area of the shape is  $75 \text{ cm}^2$ .  
This means that  $3x^2 + 2xy = 75$ .

- (a) The perimeter of the shape is 34 cm.

Show that  $3x + y = 17$ .

.....

.....

.....

.....

.....

..... [2]

- (b) Solve algebraically the equations  $3x + y = 17$  and  $3x^2 + 2xy = 75$  to find the radius,  $x$  and the length,  $y$ .

(b)  $x = \dots\dots\dots$  cm

$y = \dots\dots\dots$  cm [7]

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