Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

MATHEMATICS (SPECIFICATION A)   3301/1H
Higher Tier
Paper 1 Non-Calculator

Tuesday 11 November 2003 9.00 am to 11.00 am

H

In addition to this paper you will require:
   mathematical instruments.
You must **not** use a calculator.

Time allowed: 2 hours

Instructions

- Use blue or black ink or ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this booklet.

Information

- The maximum mark for this paper is 100.
- Mark allocations are shown in brackets.
- Additional answer paper, graph paper and tracing paper will be issued on request and must be tagged securely to this answer booklet.
- The use of a calculator is **not** permitted.

Advice

- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Pages	**Mark**
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20 – 21	
22 – 23	
TOTAL	
Examiner's Initials	

3301/1H

Formulae Sheet: Higher Tier

You may need to use the following formulae:

Volume of prism = area of cross-section × length
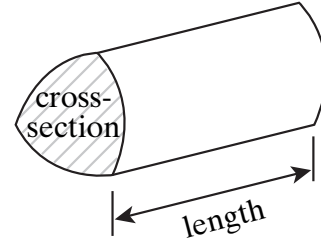
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$
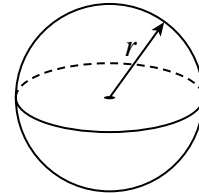
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$
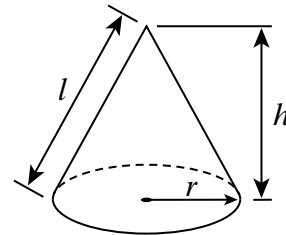
In any triangle ABC

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

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

Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$
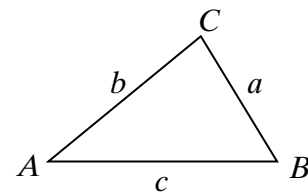
The Quadratic Equation
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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

Answer **all** questions in the spaces provided.

1 (a) You are given that $2x^3 = 250$
Find the value of x.

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Answer x = ... *(1 mark)*

(b) Write 75 as the product of its prime factors.

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Answer .... *(2 marks)*

TURN OVER FOR THE NEXT QUESTION

2 A pattern using pentagons is made of sticks.
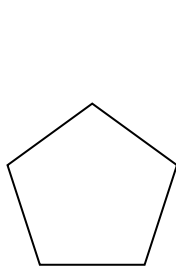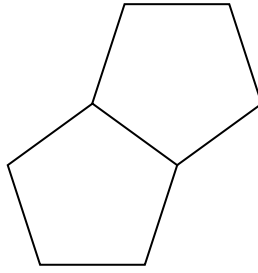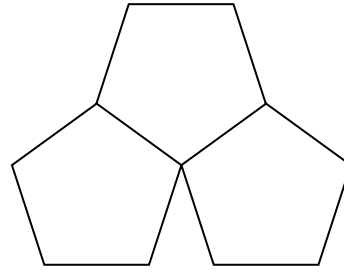
Diagram 1	Diagram 2	Diagram 3
5 sticks	9 sticks	13 sticks

(a) Write down an expression for the number of sticks in Diagram n.

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....

Answer .... *(2 marks)*

(b) Which Diagram uses 201 sticks?

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....

Answer .... *(3 marks)*

3 (a) Matthew has a dice with 3 red faces, 2 blue faces and 1 green face.
He throws the dice 300 times.
The results are shown in the table.

Red	**Blue**	**Green**
153	98	49

(i) What is the relative frequency of throwing a red?

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Answer .... *(1 mark)*

(ii) Is the dice fair?
Explain your answer.

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(2 marks)

(b) Emmie has a dice with 4 red faces and 2 blue faces.
She throws the dice 10 times and gets 2 reds.
Emmie says the dice is **not** fair.
Explain why Emmie could be wrong.

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(1 mark)

Turn over ▶

9

4 Susan completes a journey in two stages.
In stage 1 of her journey, she drives at an average speed of 80 km/h and takes 1 hour 45 minutes.

(a) How far does Susan travel in stage 1 of her journey?

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Answer .... km   *(2 marks)*

(b) Altogether, Susan drives 190 km and takes a total time of 2 hours 15 minutes.
What is her average speed, in km/h, in **stage 2** of her journey?

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Answer .... km/h   *(2 marks)*

5 *ABC* is a triangle.
ACD is a straight line.
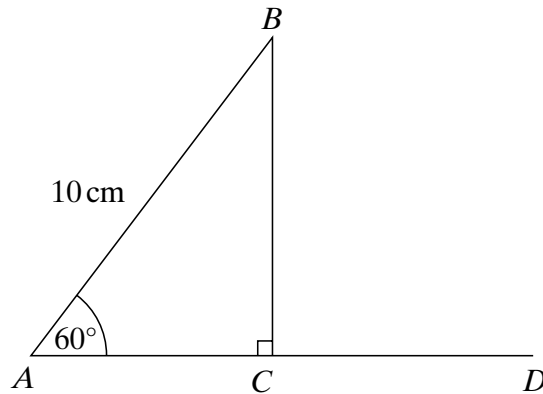
Not drawn accurately

Using a ruler and compasses only, make an accurate construction of this diagram.
You **must** show clearly all your construction arcs.
The line *AD* has been drawn for you.

A   *D*

(6 marks)

10

Turn over ▶

6 A special savings account earns 10% per year compound interest.

(a) Jill invests £2 500 in the special account.
How much will she have in her account after 2 years?

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....

Answer £ .... *(3 marks)*

(b) James also invests in the special account.
After earning interest for one year, he has £1 320 in his account.
How much money did James invest?

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Answer £ .... *(3 marks)*

7 (a) Expand and simplify $(x - 3)(2x + 1)$

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Answer .... *(2 marks)*

(b) Factorise $x^2 - 7x - 8$

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Answer .... *(2 marks)*

8 Solve the simultaneous equations

$$5x + 3y = 13$$
$$3x + 5y = 3$$

You **must** show your working.
Do **not** use trial and improvement.

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Answer $x = $ .... , $y = $ .... *(4 marks)*

$\dfrac{}{14}$

Turn over ▶

9 The diagram shows two right-angled triangles.
$AD = 15$ cm.
$CD = 6$ cm.

A

Not to scale

15 cm

$x°$

B   D

$y°$

6 cm

C
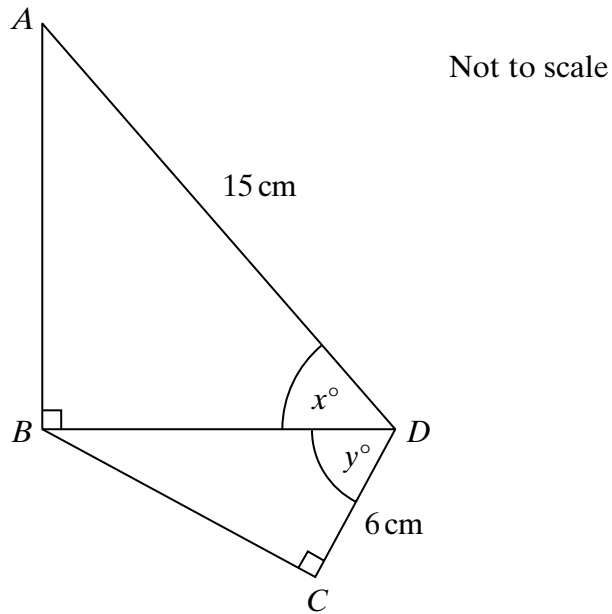
(a) Given that $\cos x° = \frac{2}{3}$, calculate the length BD.

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Answer BD = ... cm   *(2 marks)*

(b) Find the value of $\sin y°$.

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Answer $\sin y°$ = ...   *(3 marks)*

10   On the grid below, indicate clearly the region defined by the three inequalities

$$x \geqslant 1$$
$$y \geqslant x - 1$$
$$x + y \leqslant 7$$

Mark the region with an *R*.

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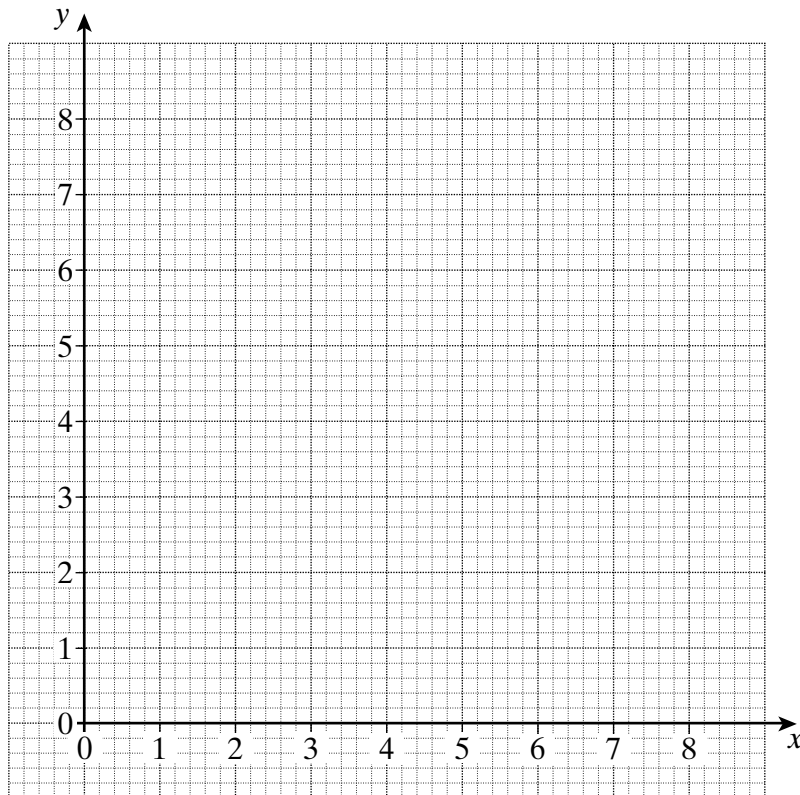
(3 marks)

Turn over ▶

11 The diagram shows a circle, centre *O*, passing through the point *P* (3,1).

Not drawn accurately
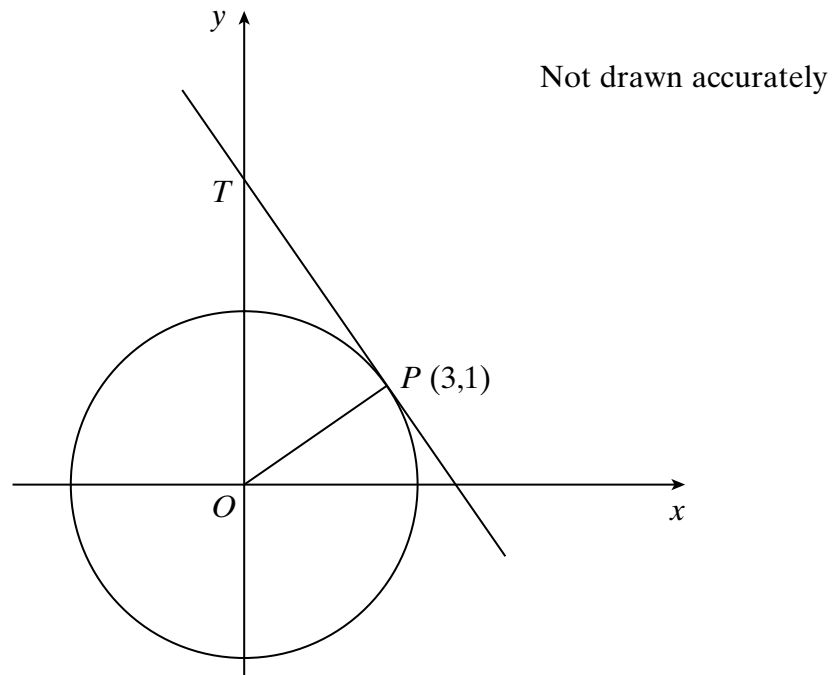
(a) (i) Find the exact length of *OP*.

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Answer .... *(2 marks)*

(ii) Hence, or otherwise, write down the equation of the circle.

....

Answer .... *(1 mark)*

(b) *PT* is the tangent to the circle at *P*.

(i) Write down the size of angle *OPT*.

Answer .... degrees *(1 mark)*

(ii) Write down the gradient of *OP*.

Answer .... *(1 mark)*

(iii) Write down the gradient of *PT*.

Answer .... *(1 mark)*

(iv) Hence, or otherwise, find the equation of the tangent *PT*.

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Answer .... *(3 marks)*

12 (a) (i) Evaluate $13z^0$

Answer .... *(1 mark)*

(ii) Evaluate $(13z)^0$

Answer .... *(1 mark)*

(b) If $3^x = \frac{1}{27}$, find the value of *x*.

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Answer *x* = ... *(2 marks)*

(c) If $4^y = 64^{\frac{1}{2}}$, find the value of *y*.

....

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Answer *y* = ... *(2 marks)*
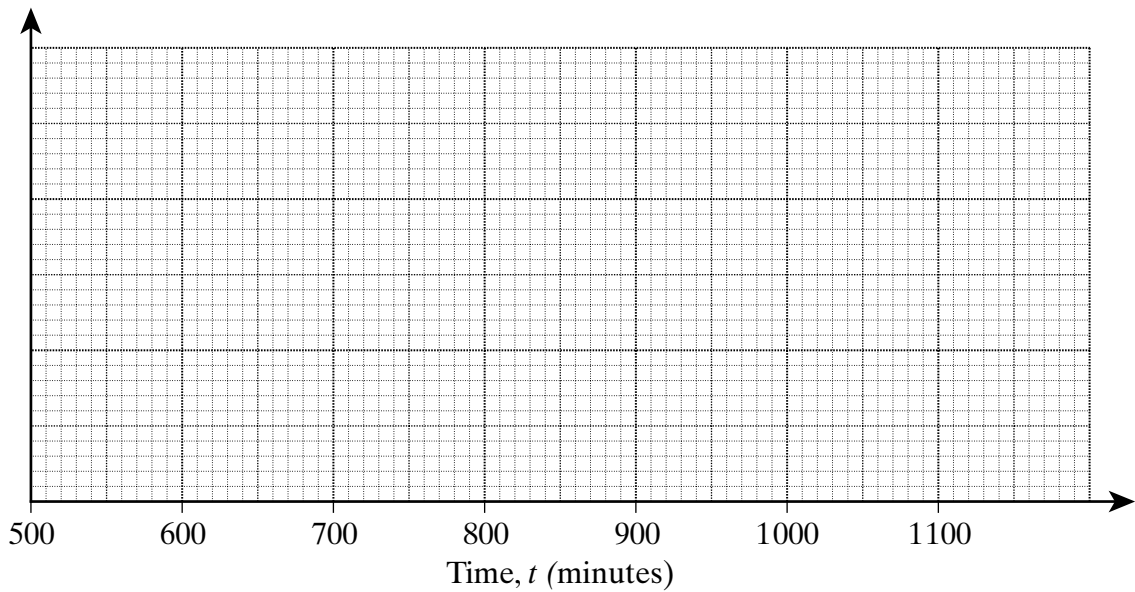
Turn over ▶

13 Batteries are tested by putting them into toys and seeing how long they last.

Here are the results of 60 tests.

Time, t (minutes)	Frequency
$500 \leqslant t < 600$	8
$600 \leqslant t < 700$	15
$700 \leqslant t < 750$	10
$750 \leqslant t < 950$	18
$950 \leqslant t < 1150$	9

(a) Draw a histogram to show this information.

Time, t (minutes)

500   600   700   800   900   1000   1100

(3 marks)

(b) Use your histogram, or otherwise, to estimate the median life of a battery.

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Answer .... minutes   *(2 marks)*

14 In an experiment measurements of t and h were taken.

These are the results.

t	2	5	6
h	10	62.5	90

Which of these rules fits the results?

(A) $h \propto t$ 　　　　　(B) $h \propto t^2$ 　　　　　(C) $h \propto t^3$

You **must** show all your working.
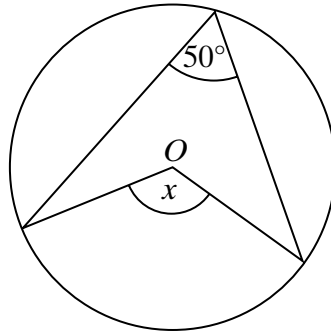
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Answer .... *(4 marks)*

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

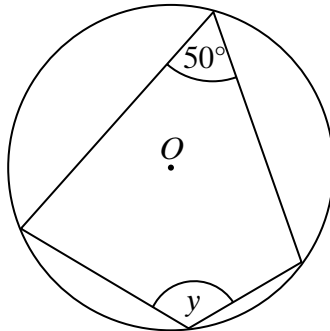**15** (a) (i) The diagram shows a circle with centre *O*.

50°

O

x

Not drawn accurately

Work out the size of the angle marked *x*.

....

....

Answer .... degrees   *(1 mark)*

(ii) The diagram shows a different circle with centre *O*.

50°

O

y

Not drawn accurately

Work out the size of the angle marked *y*.

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....

Answer .... degrees   *(1 mark)*

(b) The diagram shows a cyclic quadrilateral *ABCD*.
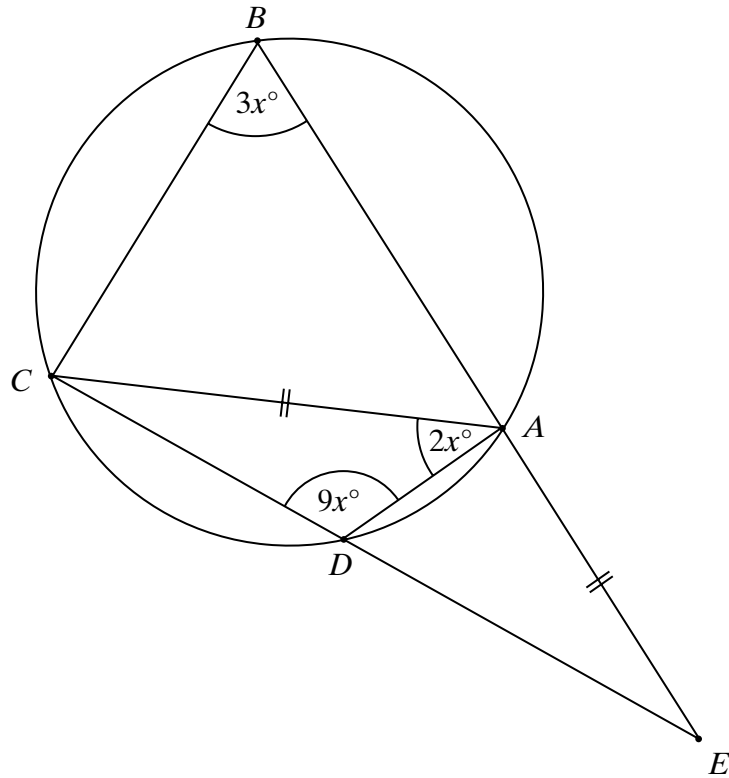The straight lines *BA* and *CD* are extended and meet at *E*.

EA = *AC*

Angle *ABC* = $3x°$

Not drawn accurately

Angle *ADC* = $9x°$

Angle *DAC* = $2x°$

(i) Show that $x = 15$

....

....

(2 marks)

(ii) Calculate the size of angle *EAD*.

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Answer .... degrees   *(4 marks)*

16 (a) (i) Expand and simplify $(3 + \sqrt{7})^2$

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Answer .... *(2 marks)*

(ii) Hence, or otherwise, show that $x = (3 + \sqrt{7})$ is a solution of the equation

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

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(2 marks)

(b) The equation $x^2 - 6x + 2 = 0$ has two solutions.

The sum of these solutions is 6

What is the second solution of the equation?

....

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Answer .... *(1 mark)*

17 Amy picks a coloured disc at random from a bag.

The probability that she picks a red disc is $\frac{2}{5}$.

Beth then picks a coloured disc at random from a different bag.

The probability that both Amy and Beth pick a red disc is $\frac{4}{15}$.

Amy's bag   Beth's bag
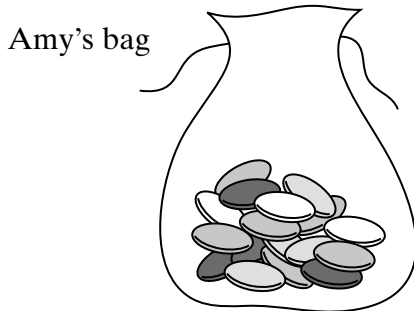
P (red disc) = $\frac{2}{5}$ P (red disc) = p

By first finding the probability that Beth picks a red disc, p, find the probability that
neither Amy nor Beth pick a red disc.

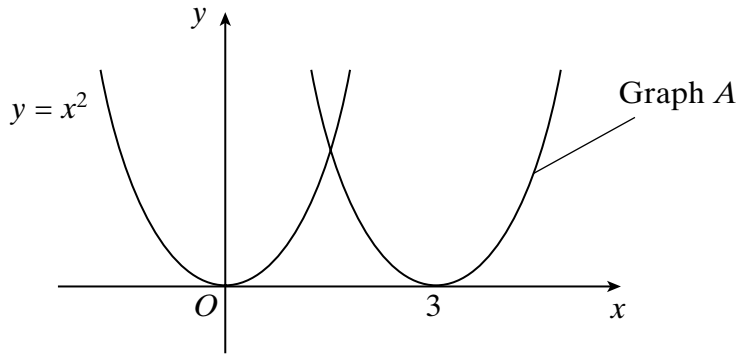..

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Answer .... *(4 marks)*
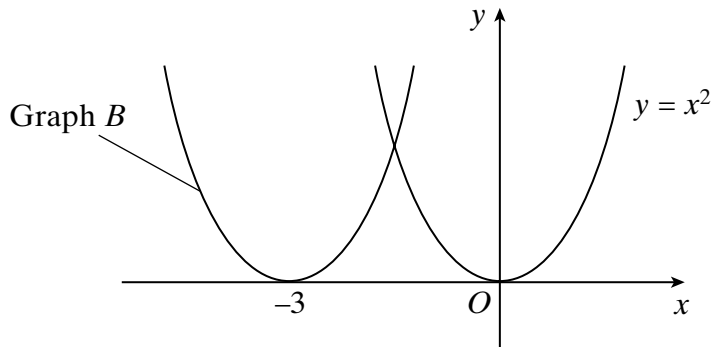
Turn over ▶

18 The diagrams, **which are not drawn to scale**, show the graph of $y = x^2$ and four other graphs A, B, C and D.

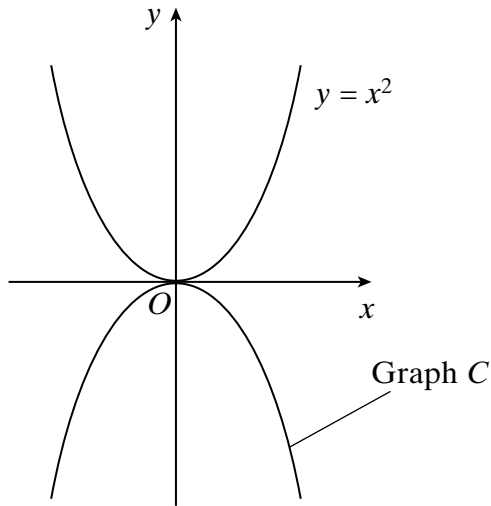A, B, C and D represent four different transformations of $y = x^2$.
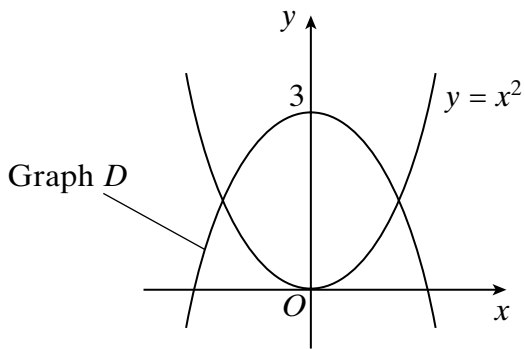
Find the equation of each of the graphs A, B, C and D.

Answer   Graph A is $y =$ ....

Answer   Graph B is $y =$ ....

Answer   Graph *C* is *y* = ...

Answer   Graph *D* is *y* = ...

(4 marks)

19 Simplify fully $\dfrac{x^2 - 16}{3x^2 + 10x - 8}$

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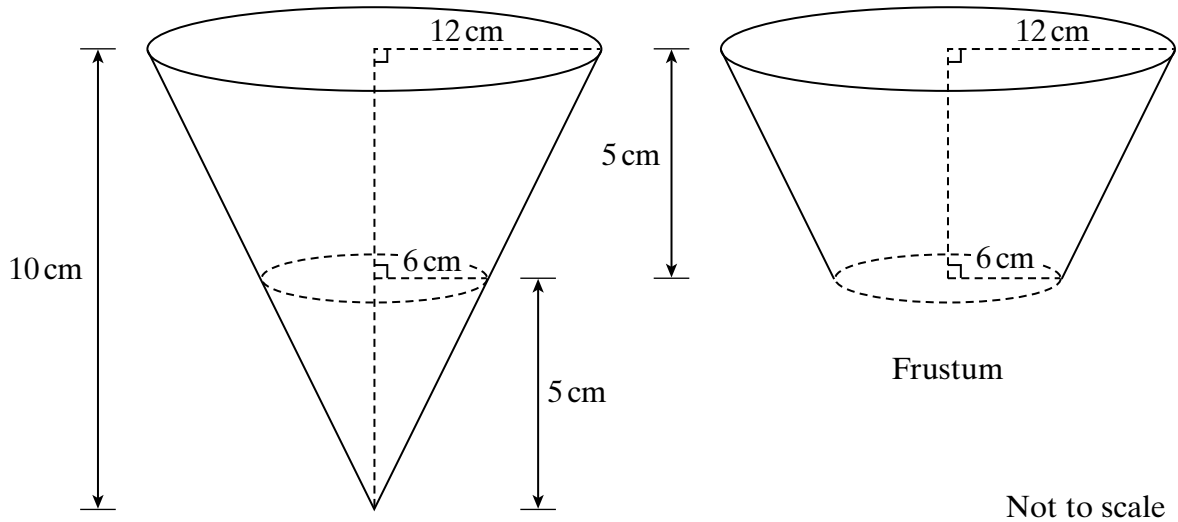Answer   ....   *(4 marks)*

Turn over ▶

20 The first diagram shows a cone of base radius 12 cm and perpendicular height 10 cm.

A small cone of base radius 6 cm and perpendicular height 5 cm is cut off the bottom to leave a frustum.

The frustum has a lower radius of 6 cm, an upper radius of 12 cm and a perpendicular height of 5 cm (see second diagram).

Not to scale

(a) Find the volume of the frustum, giving your answer in terms of π.

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Answer .... cm^3 *(4 marks)*

(b) The frustum has the same volume as another cone of perpendicular height 35 cm.

Calculate the radius of this cone.

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Answer .... cm   *(3 marks)*

END OF QUESTIONS