

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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



Level 2 Certificate in Further Mathematics
June 2012

Further Mathematics

8360/2

Level 2

Paper 2 Calculator

Friday 1 June 2012 1.30 pm to 3.30 pm

<p>For this paper you must have:</p> <ul style="list-style-type: none"> • a calculator • mathematical instruments. 	
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Time allowed

- 2 hours

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 105.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer booklet.
- The use of a calculator is expected but calculators with a facility for symbolic algebra must **not** be used.

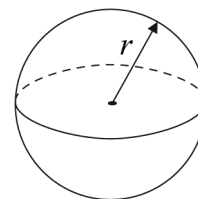


J U N 1 2 8 3 6 0 2 0 1

Formulae Sheet

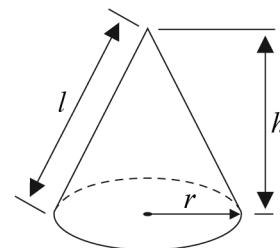
$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

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



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

$$\text{Curved surface area of cone} = \pi r l$$



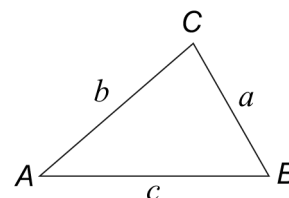
In any triangle ABC

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

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

$$\text{Cosine rule} \quad a^2 = b^2 + c^2 - 2bc \cos A$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

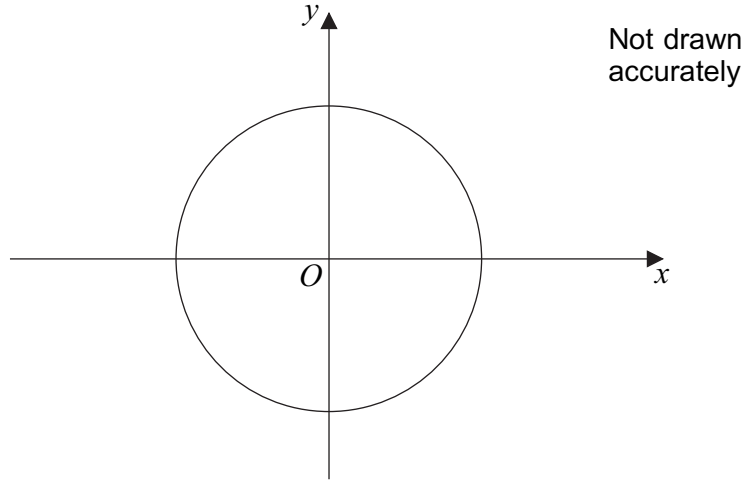
Trigonometric Identities

$$\tan \theta \equiv \frac{\sin \theta}{\cos \theta} \quad \sin^2 \theta + \cos^2 \theta \equiv 1$$



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

1 Here is a sketch of the circle $x^2 + y^2 = 36$



Work out the circumference of the circle.

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Answer..... (3 marks)

Turn over for the next question



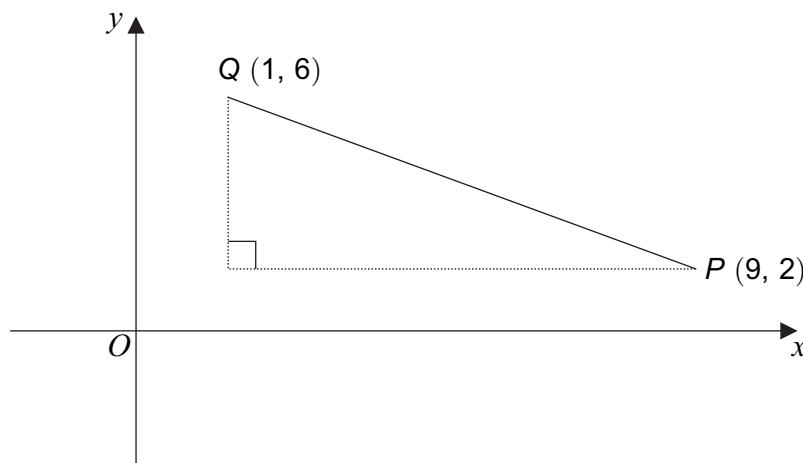
2

$$y = 5x^3 - 4x^2$$

Work out $\frac{dy}{dx}$.

$$\frac{dy}{dx} = \dots\dots\dots (2 \text{ marks})$$

3



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accurately

Work out the length of PQ .
Give your answer to 3 significant figures.

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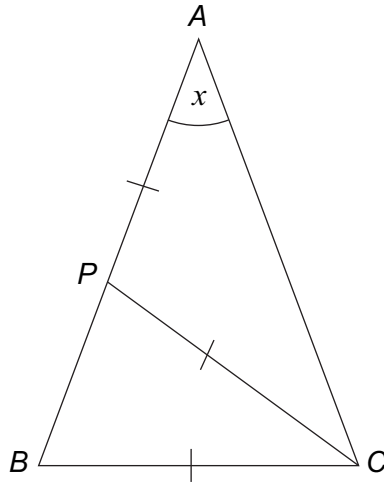
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$$PQ = \dots\dots\dots (4 \text{ marks})$$



- 5** ABC is a triangle.
 P is a point on AB such that $AP = PC = BC$
 Angle $BAC = x$



Not drawn accurately

- 5 (a)** Prove that angle $ABC = 2x$

.....

(3 marks)

- 5 (b)** You are also given that $AB = AC$

Work out the value of x .

.....

$x =$ degrees (3 marks)



6 (a) Expand $3x(2x - 5y)$

Answer..... (2 marks)

6 (b) Expand and simplify $(3x + 2y)(3x - 4y)$

.....
.....
.....

Answer..... (3 marks)

6 (c) Work out the ratio $(3x + 2y)(3x - 4y) : 3x(2x - 5y)$ when $y = 0$

Give your answer as simply as possible.

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.....
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Answer..... : (2 marks)

7 $1 \leq m \leq 5$ and $-9 \leq n \leq 2$

7 (a) Work out an inequality for $m + n$.

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Answer..... $\leq m + n \leq$ (2 marks)

7 (b) Work out an inequality for $(m + n)^2$.

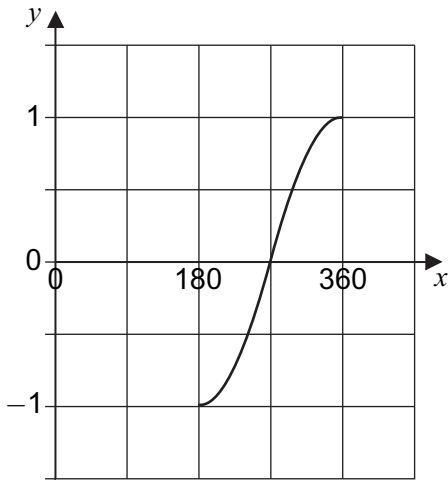
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Answer..... $\leq (m + n)^2 \leq$ (2 marks)

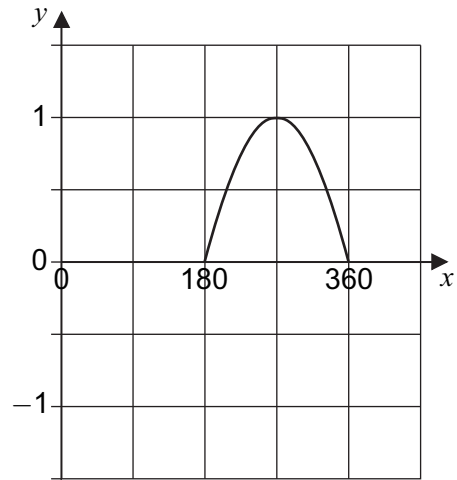


8 Four graphs are shown for $180^\circ \leq x \leq 360^\circ$

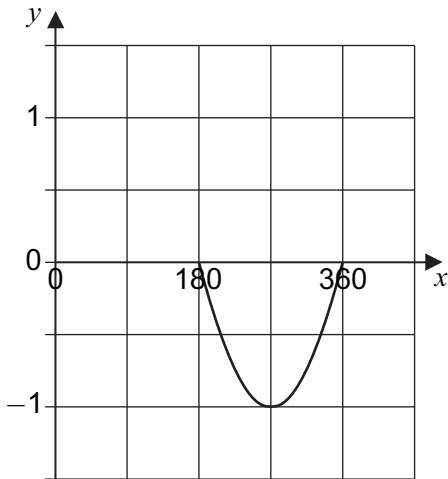
Graph A



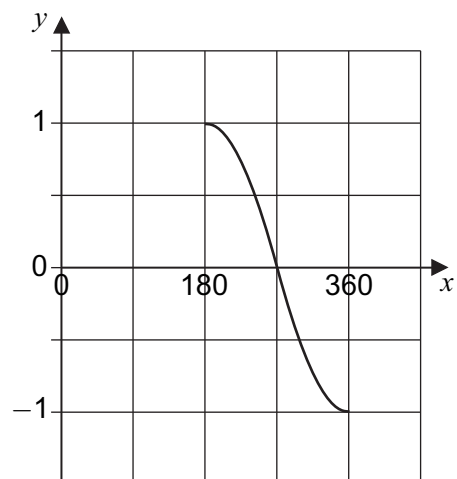
Graph B



Graph C



Graph D



8 (a) Which graph is $y = \sin x$?

Graph (1 mark)

8 (b) Which graph is $y = \cos x$?

Graph (1 mark)



9 Here is a formula.

$$5t + 3 = 4w(t + 2)$$

9 (a) Rearrange the formula to make t the subject.

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Answer..... (4 marks)

9 (b) Work out the exact value of t when $w = -\frac{1}{8}$

Give your answer in its simplest form.

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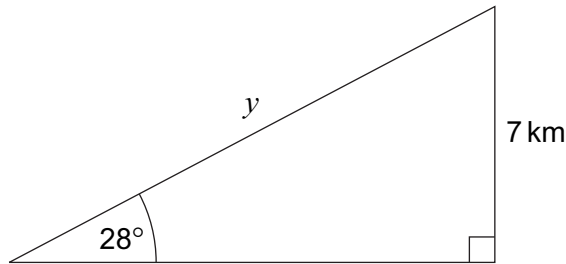
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$t =$ (3 marks)



- 10** An aircraft flies y kilometres in a straight line at an angle of elevation of 28° .
The gain in height is 7 kilometres.



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accurately

Work out the value of y .

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$y = \dots\dots\dots$ km (3 marks)

- 11** A sphere has radius x centimetres.
A hemisphere has radius y centimetres.
The shapes have equal volumes.

Work out the value of $\frac{y}{x}$.

Give your answer in the form $a^{\frac{1}{3}}$ where a is an integer.

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$\frac{y}{x} = \dots\dots\dots$ (3 marks)



12

Expand and simplify $(t + 4)^3$

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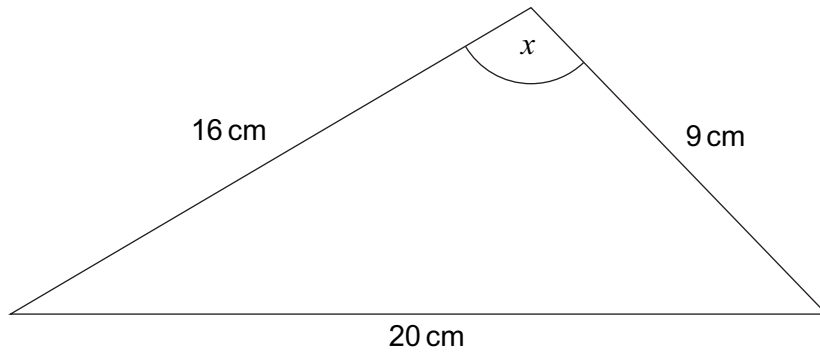
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Answer..... (3 marks)

13



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accurately

Work out angle x .

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$x =$ degrees (3 marks)

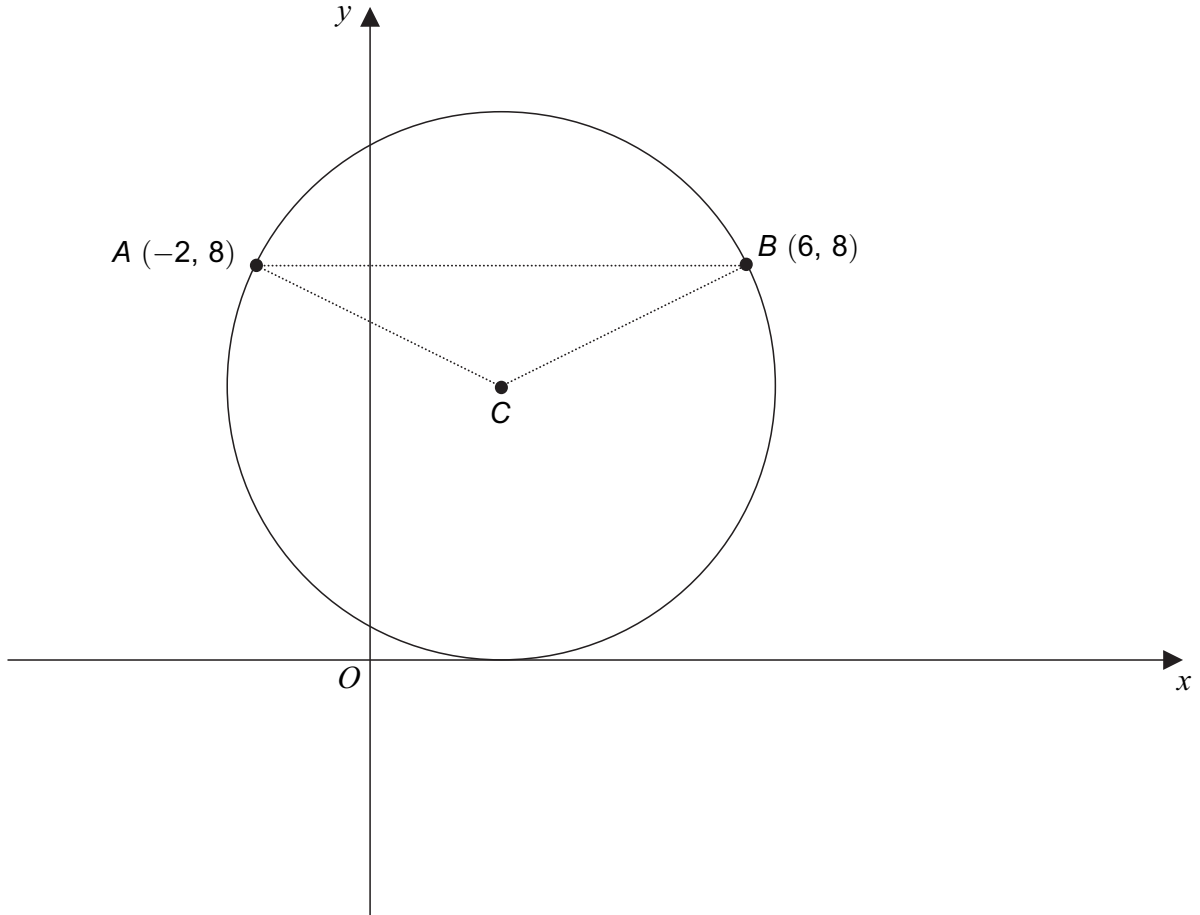
12

Turn over ►



14

The sketch shows a circle, centre C , radius 5.
The circle passes through the points $A (-2, 8)$ and $B (6, 8)$.
The x -axis is a tangent to the circle.



Work out the equation of the circle.

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Answer..... (4 marks)



15 (a) $f(x) = 3x - 5$ for all values of x .

Solve $f(x^2) = 43$

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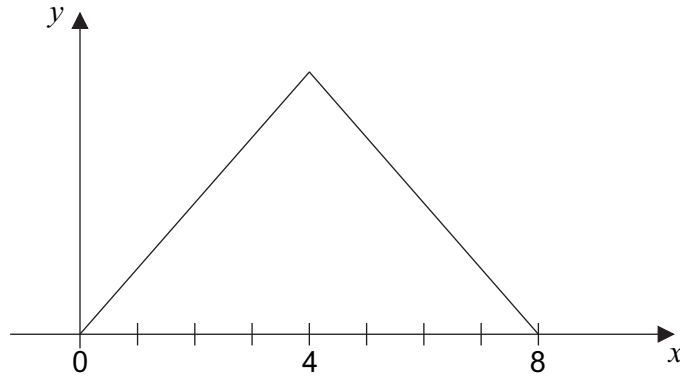
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Answer..... (4 marks)

15 (b) A sketch of $y = g(x)$ for domain $0 \leq x \leq 8$ is shown.



The graph is symmetrical about $x = 4$
The range of $g(x)$ is $0 \leq g(x) \leq 12$

Work out the function $g(x)$.

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$g(x) =$ $0 \leq x \leq 4$
..... $4 < x \leq 8$

(5 marks)



16 (a) Use the factor theorem to show that $(x - 1)$ and $(x - 4)$ are factors of $x^3 - 21x + 20$

.....

(2 marks)

16 (b) Show that $(x - 1)$ and $(x - 4)$ are also factors of $x^3 - 10x^2 + 29x - 20$

.....

(2 marks)

16 (c) Hence, simplify fully $\frac{x^3 - 21x + 20}{x^3 - 10x^2 + 29x - 20}$

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Answer..... (3 marks)

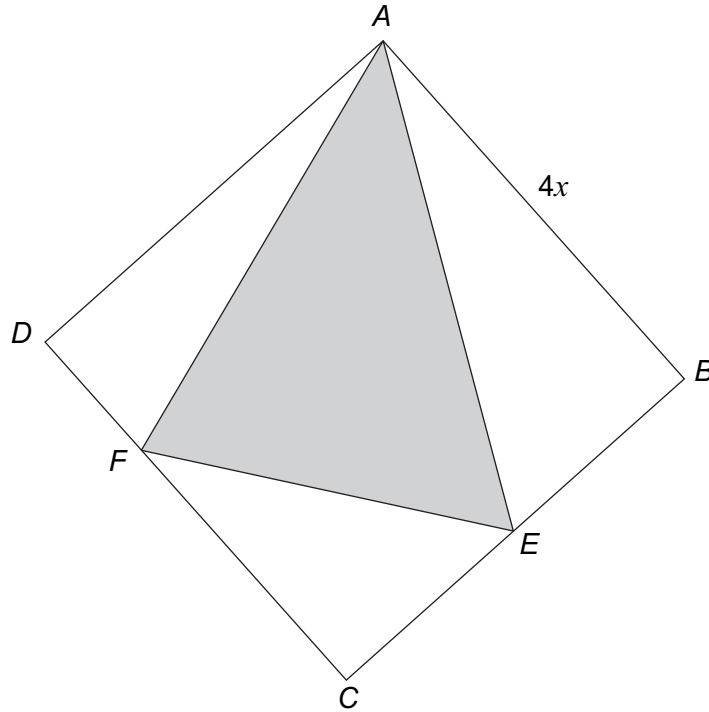


17

$ABCD$ is a square of side length $4x$.

E is the midpoint of BC .

$DF:FC = 1:3$



Not drawn
accurately

You are given that

$$\text{area of triangle } AEF = kx^2$$

Work out the value of k .

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$k = \dots\dots\dots$ (5 marks)

Turn over ►



18

$$(x - 5)^2 + a \equiv x^2 + bx + 28$$

Work out the values of a and b .

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$a = \dots\dots\dots b = \dots\dots\dots$ (3 marks)

19

Solve the simultaneous equations

$$\begin{aligned} x + y &= 4 \\ y^2 &= 4x + 5 \end{aligned}$$

Do **not** use trial and improvement.

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Answer..... (6 marks)



20 For what values of x is $y = 150x - 2x^3$ an increasing function?

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Answer..... (4 marks)

Turn over for the next question



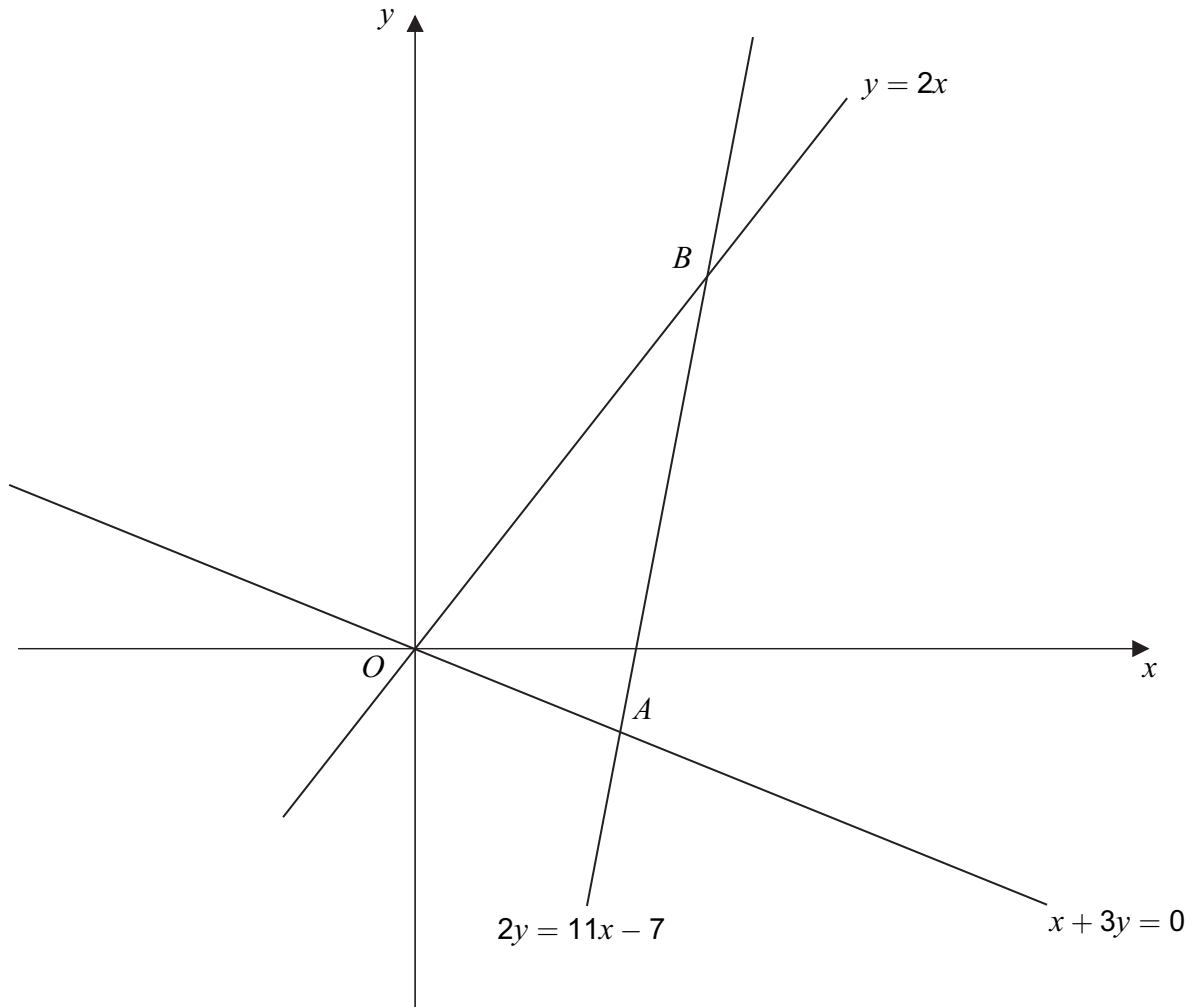
21

The equations of three straight lines are

$$y = 2x$$

$$x + 3y = 0$$

$$2y = 11x - 7$$

The lines intersect at the points O , A and B as shown on this sketch.

22 The transformation matrix $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ maps point P to point Q .

The transformation matrix $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ maps point Q to point R .

Point R is $(-4, 3)$.

Work out the coordinates of point P .

Answer (..... ,)

(5 marks)



23 The curve $y = f(x)$ is such that $\frac{dy}{dx} = -x(x - 2)^2$

The stationary points of the curve are at $\left(0, \frac{4}{3}\right)$ and $(2, 0)$.

Determine the nature of each stationary point.
You **must** show your working.

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(4 marks)

END OF QUESTIONS



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