Write your name here

Surname	Other Names

Mathematics

2019 Practice Paper
Paper 3 (Calculator)
Higher Tier

Time: 1 hour 30 minutes

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – there may be more space than you need.
- **Calculators may be used**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working.**

Information

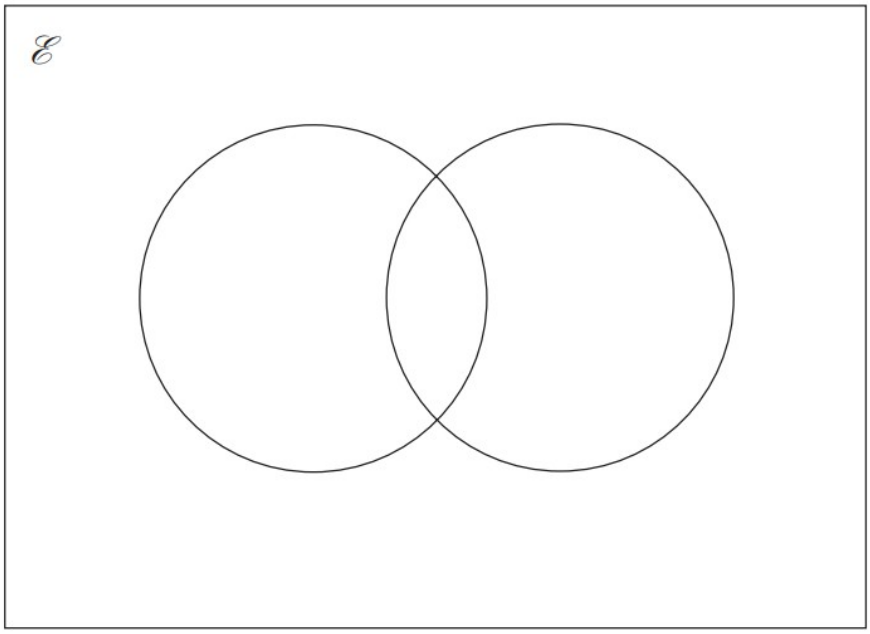
- The total mark for this paper is 80
- The marks for **each** question are shown in brackets – use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

1 $\mathscr{E}$ = {even numbers between 1 and 31}
A = {2, 4, 8, 14, 18, 22, 28}
B = {8, 10, 16, 18, 22, 30}

(a) Complete the Venn diagram to represent this information.



(4)

A number is chosen at random from the universal set, $\mathscr{E}$

(b) What is the probability that the number is in the set $A \cup B$?

….....……

(2)

(Total for question 1 is 6 marks)

2 The frequency table shows the time taken for 100 people to travel to an event.

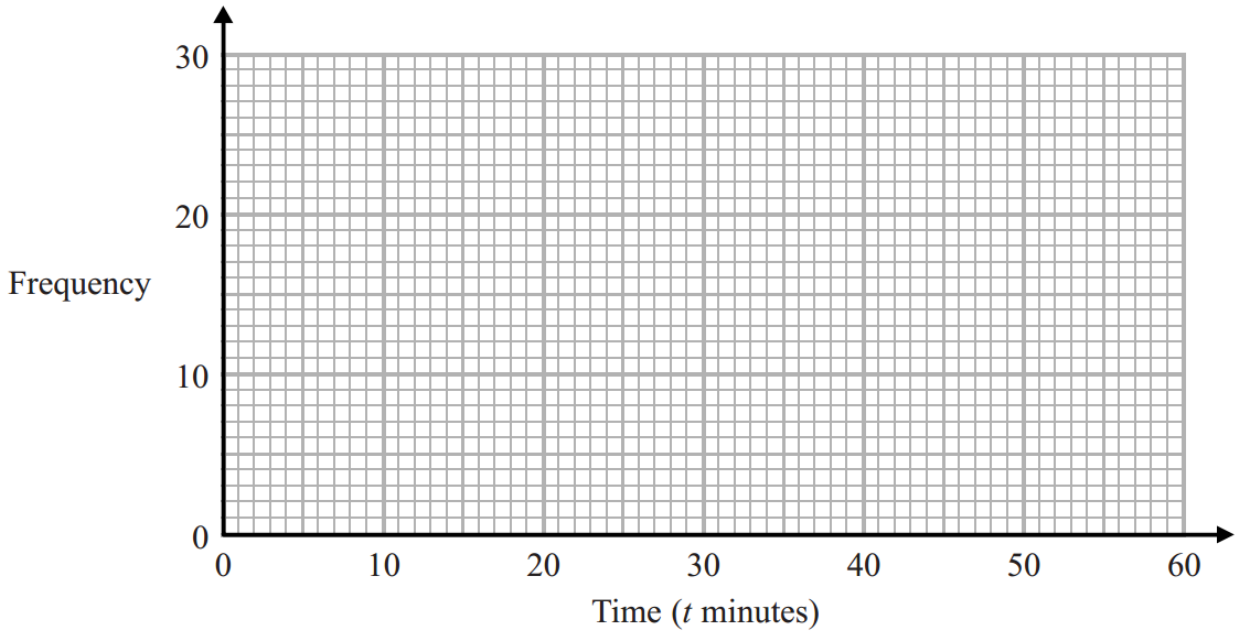
Time (minutes)	Frequency
$0 < t \leqslant 10$	14
$10 < t \leqslant 20$	16
$20 < t \leqslant 30$	23
$30 < t \leqslant 40$	29
$40 < t \leqslant 50$	12
$50 < t \leqslant 60$	6

(a) Find the percentage of people that travelled for more than 30 minutes to the event

.....%

(1)

(b) Draw a frequency polygon for the information on the table.



(2)

(Total for question 2 is 4 marks)

3 (a) Find the reciprocal of 8

.....…

(1)

(b) Use your calculator to work out $(2 \cos 40° + 3 \sin 25°)^3$
Write down all the figures on your calculator display.

….....….....…

(2)

(Total for question 3 is 3 marks)

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4 Solve the simultaneous equations

$2x + 5y = 2$
$7x - 4y = -1$

x = ...…

y = ...…

(Total for question 4 is 3 marks)

5 A is the point with coordinates (3, 8)
B is the point with coordinates (x, 13)

The gradient of AB is 2.5
Work out the value of x

.....

(Total for question 5 is 2 marks)

6 (a) Olivia is going to invest some money for 5 years.

She can choose from two options:

Investment A: 2.7% compound interest per annum

Investment B: 2.8% simple interest per annum

Which investment should Olivia choose
You must show your working.

(Total for question 6 is 4 marks)

7 The exchange rate in London is £1 = $1.31

The exchange rate in New York is $1 = £0.79

Bernie wants to change some pounds into dollars.

In which of these cities would Bernie get the most dollars?
You must show your working.

(Total for question 7 is 3 marks)

8 Each year Rose buys an annual ticket for his train journey to work.

The price of Rose's ticket increased by 2% in 2017 and 3% in 2018.

The ticket cost £2534 in 2018.

What was the price of the ticket in 2016?

£……

(Total for question 8 is 3 marks)

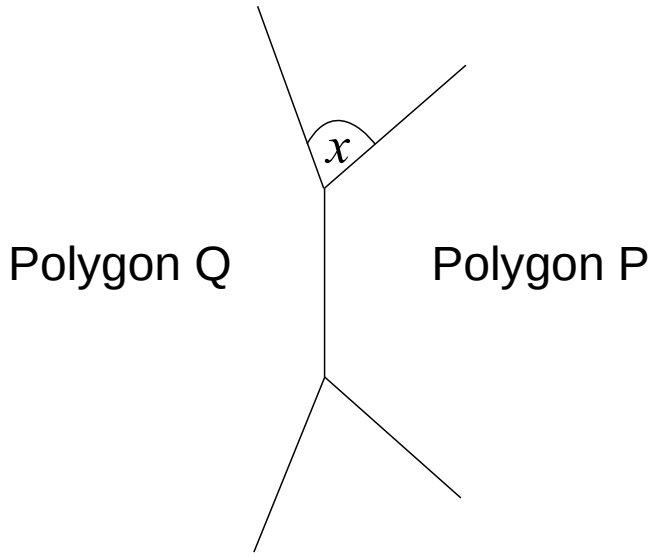
9 Last year Patrick paid £2534 for his annual train ticket.
This year he has to pay £2612 for his annual train ticket.

Work out the percentage increase in the cost of his train ticket.
Give your answer correct to 3 significant figures.

……%

(Total for question 9 is 3 marks)

10 Two regular polygons P and Q have a common side as shown in the diagram.



Polygon P has n sides. Polygon Q has twice as many sides as Polygon P.

Find the size of angle x in terms of n.

….....……

(Total for question 10 is 3 marks)

11 Liquid **A** has a density of 1.2 g/cm^3

150 cm^3 of Liquid **A** is mixed with some of Liquid **B** to make Liquid **C**.

Liquid **C** has a mass of 210 g and a density of 1.12 g/cm^3

Find the density of Liquid **B**.

…….g/cm^3

(Total for question 11 is 3 marks)

12 Emma has a bag containing a large number of beads.
She wants to find an estimate for the number of beads in the bag.

Emma takes a sample of 50 beads from the bag.
She marks each bead with a black cross and then puts the beads back in the bag.

Emma shakes the bag.
She now takes another sample of 50 beads from the bag.

6 of these beads have been marked with a black cross.

Work out an estimate for the total number of beads in the bag.

…….....……

(Total for question 12 is 2 marks)

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13 A radioactive substance decays by x % each day. After 8 days half of the substance has decayed.
Find the value of x.
Give your answer to 1 decimal place.

…….....……

(Total for question 13 is 3 marks)

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14 (a) Expand and simplify $(x + 5)(x + 3)(x – 4)$

.....

(3)

(b) Solve $3x^2 – 5x – 7 = 0$
Give your solutions correct to 3 significant figures

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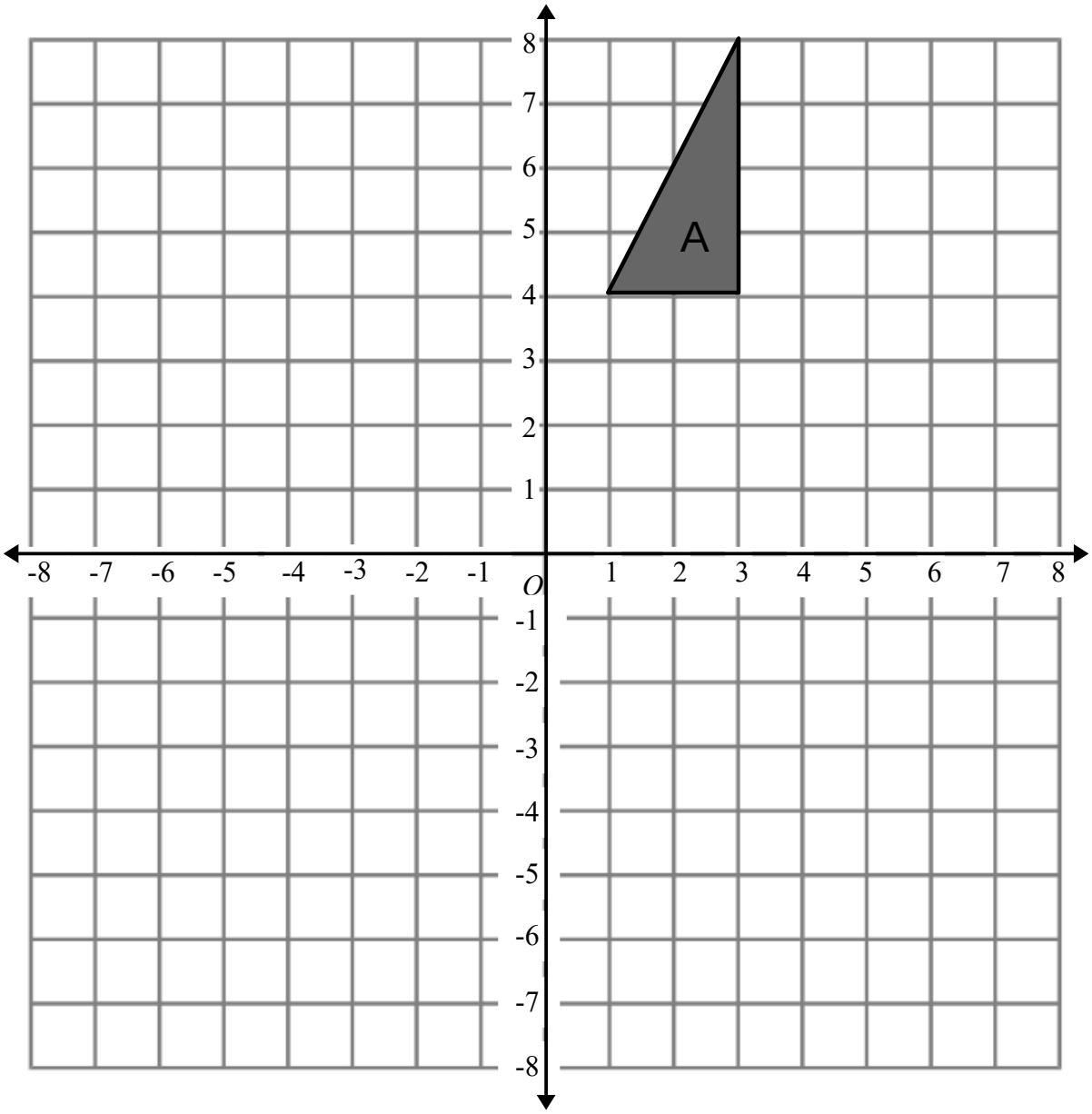
(3)

(Total for question 14 is 6 marks)

15



Triangle A is reflected in the line $y = -x$ to give triangle B

Triangle B is reflected in the line $x = -2$ to give triangle C

Describe the single transformation which maps triangle A onto triangle C.

…….....…….....…….....…….....…….....…….....…….....…….....…….....…

…….....…….....…….....…….....…….....…….....…….....…….....…….....…

(Total for question 15 is 3 marks)

16 Prove algebraically that the recurring decimal $0.\dot{3}\dot{1}\dot{5}$ can be written as $\frac{35}{111}$

(Total for question 16 is 2 marks)

17 Here are the first 5 terms of a quadratic sequence.

5 11 22 38 59

Find an expression, in terms of n, for the nth term of this sequence.

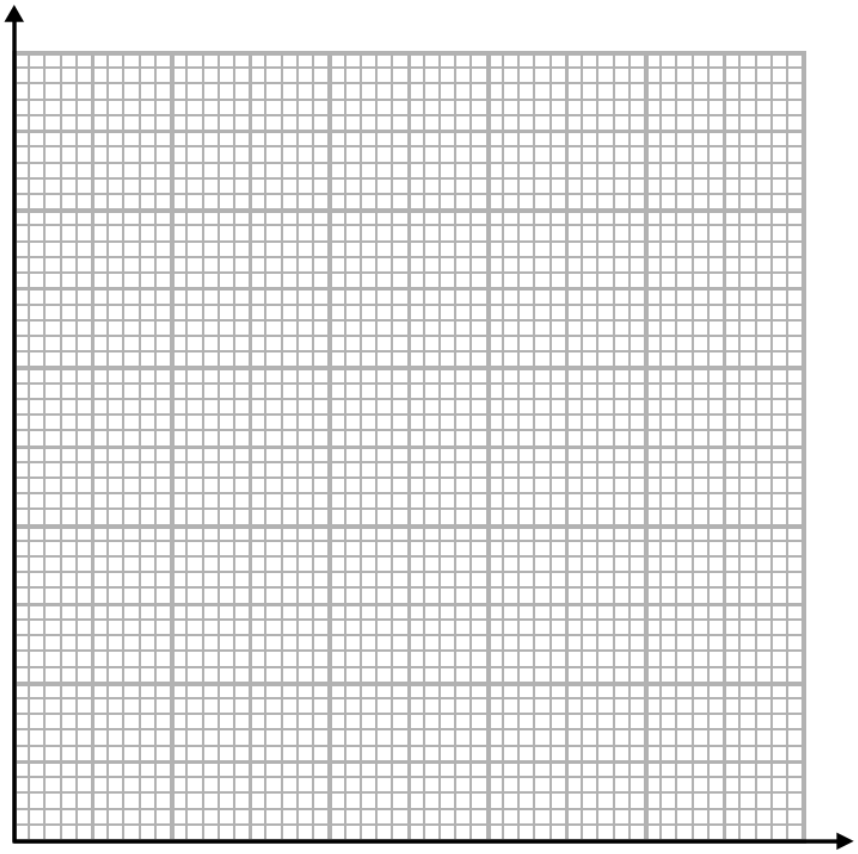
…….....…….....

(Total for question 17 is 3 marks)

18 The table shows information about the weight of 60 pigs.

Weight (kg)	Frequency
$60 < w \leqslant 75$	9
$75 < w \leqslant 85$	16
$85 < w \leqslant 90$	25
$90 < w \leqslant 110$	10

(a) On the grid, draw a histogram for the information in the table.



(3)

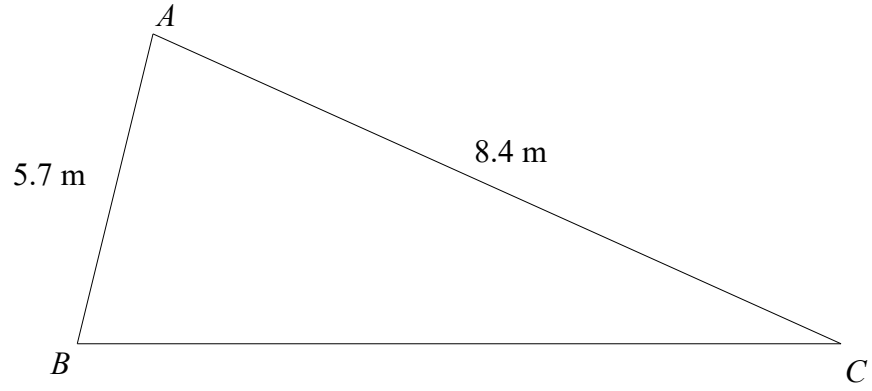
(b) Find an estimate for the median.

….....kg

(2)

(Total for question 18 is 5 marks)

19



The area of the triangle is $21m^2$
Calculate the perimeter of triangle *ABC*.
Give your answer to 1 decimal place.

….....m

(Total for question 19 is 5 marks)

20 (a) Show that the equation $x^3 - 4x^2 + 1 = 0$ has a solution between $x = 3$ and $x = 4$

(2)

(b) Show that the equation $x^3 - 4x^2 + 1 = 0$ can be rearranged to give: $x = \sqrt[3]{4x^2 - 1}$

(1)

(c) Starting with $x_0 = 4$, use the iteration formula $x_{n+1} = \sqrt[3]{4x_n^2 - 1}$ to find the value of x_2

Give your answer to 3 decimal places.

…….....

(3)

(Total for question 20 is 6 marks)

21 $f = \dfrac{\sqrt{g}}{h}$

g = 12.5 correct to 3 significant figures
h = 15.02 correct to 4 significant figures

By considering bounds, work out the value of f to a suitable degree of accuracy.
Give a reason for your answer.

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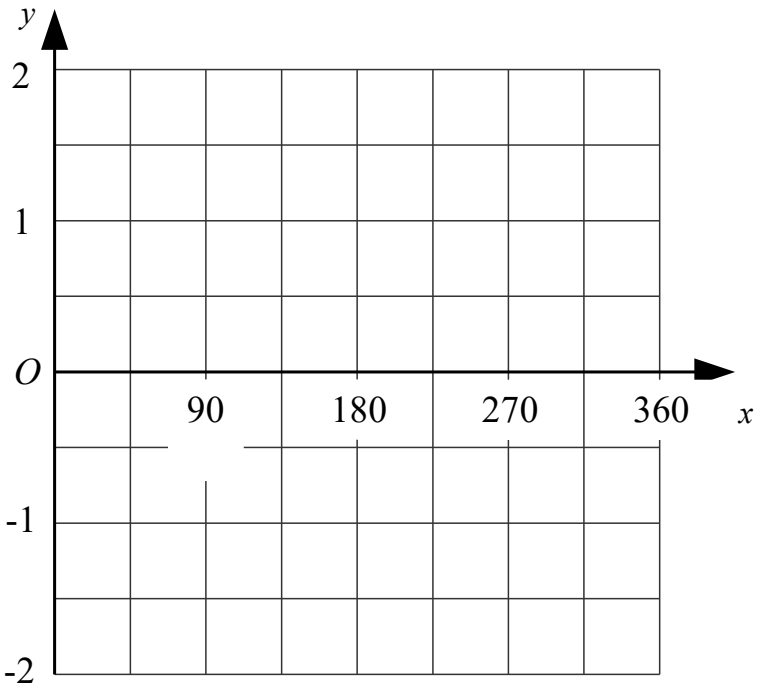
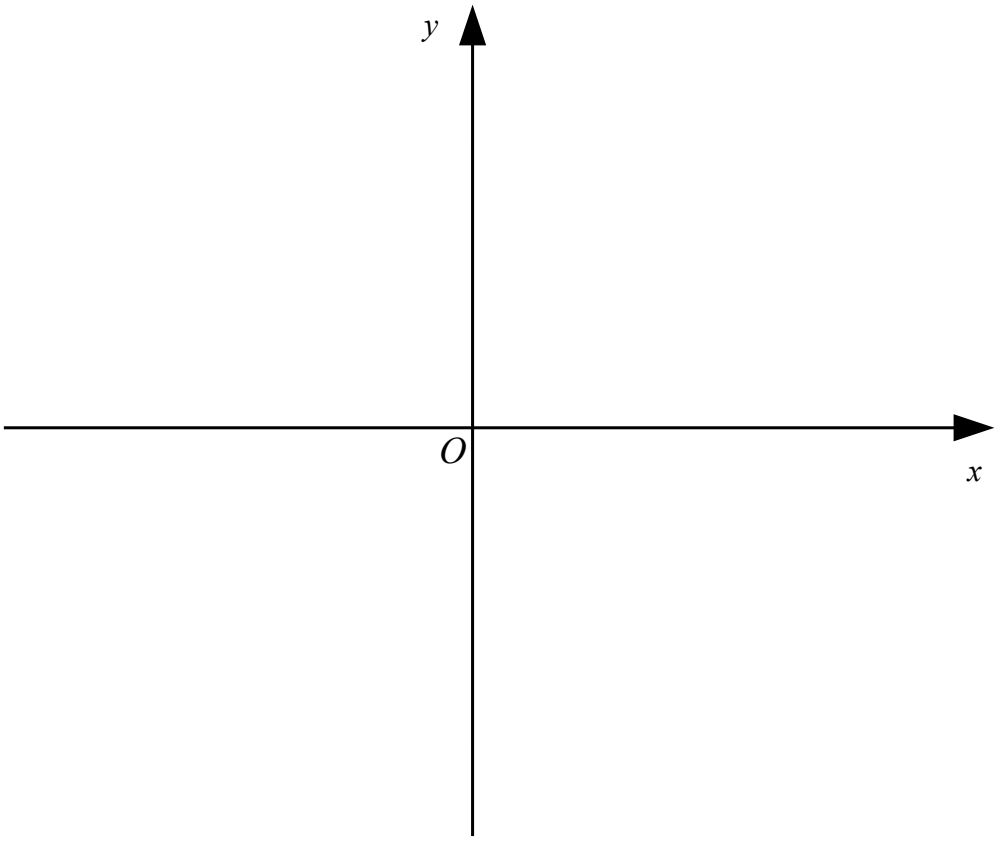
(Total for question 21 is 5 marks)

22 (a) On the graph draw a sketch of $y = \cos(x + 90) - 1$ for the values $0° \leq x \leq 360°$



(2)

(b) Sketch the graph of $x^2 + y^2 = 1.96$



(2)

(Total for question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS