

|               |  |  |  |  |  |                 |   |   |   |   |   |         |            |           |  |
|---------------|--|--|--|--|--|-----------------|---|---|---|---|---|---------|------------|-----------|--|
| Centre No.    |  |  |  |  |  | Paper Reference |   |   |   |   |   | Surname | Initial(s) |           |  |
| Candidate No. |  |  |  |  |  | 5               | 5 | 4 | 0 | H | / | 4       | H          | Signature |  |

Paper Reference(s)

**5540H/4H**

**Edexcel GCSE**

**Mathematics A (Linear) – 2540**

Paper 4 (Calculator)

**Higher Tier**

Wednesday 12 November 2008 – Morning

Time: 1 hour 45 minutes

Examiner's use only

|  |  |  |
|--|--|--|
|  |  |  |
|--|--|--|

Team Leader's use only

|  |  |  |
|--|--|--|
|  |  |  |
|--|--|--|



**Materials required for examination**

Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

**Items included with question papers**

Nil

**Instructions to Candidates**

In the boxes above, write your centre number, candidate number, your surname, initials and signature. Check that you have the correct question paper.

Answer ALL the questions. Write your answers in the spaces provided in this question paper.

**You must NOT write on the formulae page. Anything you write on the formulae page will gain NO credit.**

If you need more space to complete your answer to any question, use additional answer sheets.

**Information for Candidates**

The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2).

There are 27 questions in this question paper. The total mark for this paper is 100.

There are 24 pages in this question paper. Any blank pages are indicated.

**Calculators may be used.**

If your calculator does not have a  $\pi$  button, take the value of  $\pi$  to be 3.142 unless the question instructs otherwise.

**Advice to Candidates**

Show all stages in any calculations.

Work steadily through the paper. Do not spend too long on one question.

If you cannot answer a question, leave it and attempt the next one.

Return at the end to those you have left out.

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*Turn over*

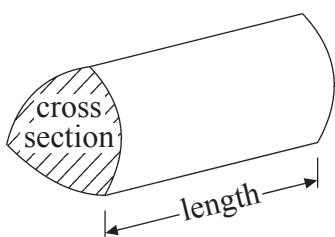
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## GCSE Mathematics (Linear) 2540

Formulae: Higher Tier

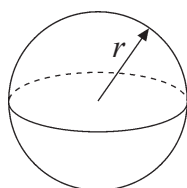
**You must not write on this formulae page.**  
**Anything you write on this formulae page will gain NO credit.**

**Volume of a prism** = area of cross section  $\times$  length



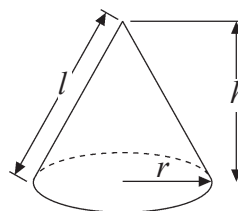
**Volume of sphere** =  $\frac{4}{3} \pi r^3$

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

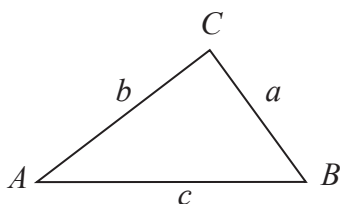


**Volume of cone** =  $\frac{1}{3} \pi r^2 h$

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



**In any triangle ABC**



**The Quadratic Equation**

The solutions of  $ax^2 + bx + c = 0$

where  $a \neq 0$ , are given by

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

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



Answer ALL TWENTY SEVEN questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1. Here are the ingredients for making cheese pie for 6 people.

Cheese pie for 6 people

180 g flour

240 g cheese

80 g butter

4 eggs

160 ml milk

Bill makes a cheese pie for 3 people.

- (a) Work out how much flour he needs.

$$180\text{g} \div 2 = 90\text{g}$$

90 ✓  
..... g  
(2)

2

Jenny makes a cheese pie for 15 people.

- (b) Work out how much milk she needs.

$$\frac{15}{6} = 2\frac{1}{2}$$

$$160\text{ml} \times 2\frac{1}{2} = 400\text{ml}$$

400 ✓  
..... ml  
(2)

2

(Total 4 marks)

Q1  
4



Leave  
blank

2. Use a calculator to work out

$$\sqrt{\frac{21.6 \times 15.8}{3.8}}$$

(a) Write down all the figures on your calculator display.

9.476841579

9.476841579 ✓

2

(2)

(b) Give your answer to part (a) correct to 3 significant figures.

9.476841579  
 ↑  
 more than 5

9.48 ✓

1

(1)

(Total 3 marks)

Q2  
33. The cost of a radio is the list price plus VAT at  $17\frac{1}{2}\%$ .

The list price of a radio is £240

Work out the cost of the radio.

$$17\frac{1}{2}\% = 0.175$$

$$\text{Multiplier } 1 + 0.175 = 1.175$$

$$240 \times 1.175 = 282$$

£ 282 ✓

(Total 3 marks)

Q3  
3

Leave blank

4. (a) Expand  $4(x - 3)$

$$4(x-3) = 4x - 12$$

$$4x - 12 \checkmark$$

.....  
(1)

(b) Solve  $4t + 1 = 19$

$$\begin{aligned} (-1) \quad 4t &= 18 \\ (\div 4) \quad t &= 4.5 \end{aligned}$$

$$t = 4.5 \checkmark$$

.....  
(2)

(Total 3 marks)

Q4  
3

5. The  $n$ th term of a sequence is  $n^2 + 4$

Alex says

“The  $n$ th term of the sequence is always a prime number when  $n$  is an odd number.”

Alex is wrong.

Give an example to show that Alex is wrong.

| $n$       | 1 | 3  | 5  | 7  | 9  |
|-----------|---|----|----|----|----|
| $n^2$     | 1 | 9  | 25 | 49 | 81 |
| $n^2 + 4$ | 5 | 13 | 29 | 53 | 85 |

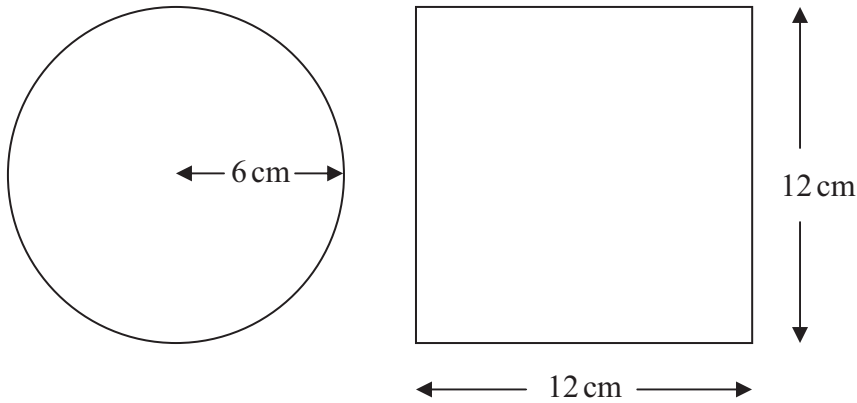
when  $n = 9$   
 $n^2 + 4 = 85$   
 85 is NOT prime

(Total 2 marks)

Q5  
2



6.

Diagram NOT  
accurately drawn

A circle has a radius of 6 cm.

A square has a side of length 12 cm.

Work out the difference between the area of the circle and the area of the square.

Give your answer correct to one decimal place.

Area of circle

$$= \pi r^2$$

$$= 36\pi$$

Difference

$$144 - 36\pi$$

$$= 30.90266447$$

$$= 30.9 \text{ cm}^2 \text{ (1dp)}$$

$$\dots\dots\dots 30.9 \text{ cm}^2$$

Area of square

$$= 12^2 = 144$$

(Total 4 marks)

Q6

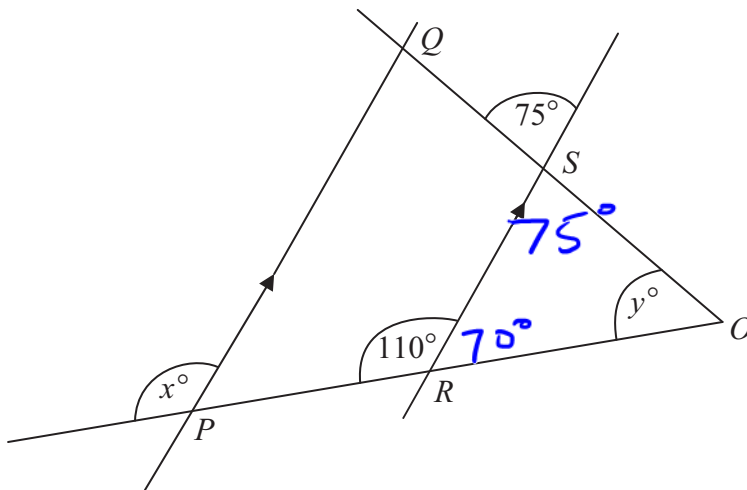
4



Leave blank

7.

Diagram NOT accurately drawn



$PQ$  is parallel to  $RS$ .

$OSQ$  and  $ORP$  are straight lines.

(a) (i) Write down the value of  $x$ .

$x = 110^\circ$  ✓

(ii) Give a reason for your answer.

$x^\circ$  is a corresponding angle to  $110^\circ$  ✓

(2)

(b) Work out the value of  $y$ .

$$y^\circ = 180^\circ - (70^\circ + 75^\circ)$$

$$= 180^\circ - 145^\circ$$

$$= 35^\circ$$

$y = 35^\circ$  ✓

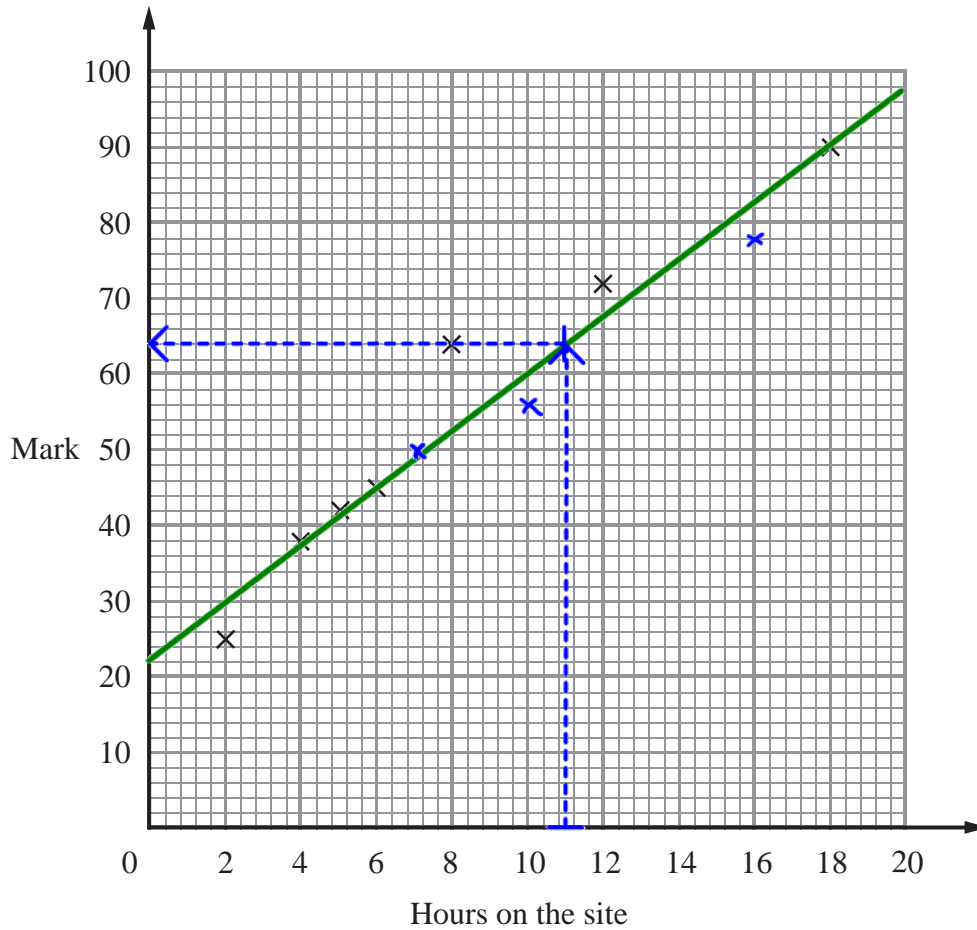
(2)

(Total 4 marks)

Q7  
4



8. Some students revised for a mathematics exam. They used an internet revision site. The scatter graph shows the times seven students spent on the internet revision site and the marks the students got in the mathematics exam.



Here is the information for 3 more students.

|                   |    |    |    |
|-------------------|----|----|----|
| Hours on the site | 7  | 10 | 16 |
| Mark              | 50 | 56 | 78 |

- (a) Plot this information on the scatter graph. (1)
- (b) What type of correlation does this scatter graph show? (1)
- POSITIVE ✓
- 
- (c) Draw a line of best fit on the scatter graph. (1)





A student spent 11 hours on the internet revision site.

(d) Use the line of best fit to estimate this student's mathematics exam mark.

62-67  
64 ✓

(1)

(Total 4 marks)

Leave blank

1

Q8

4

9. Jack invests £3000 for 2 years at 4% per annum compound interest.

Work out the value of the investment at the end of 2 years.

$4\% = 0.04$

Multiplier = 1.04

$£3000 \times 1.04^2 = 3244.80$

£ 3244.80 ✓

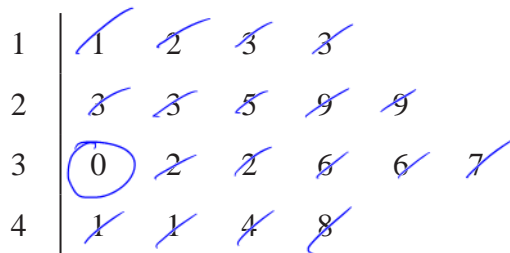
(Total 3 marks)

Q9

3

10. Jason collected some information about the heights of 19 plants.

This information is shown in the stem and leaf diagram.



Key 4|8 means 48 mm

Find the median.

30 ✓  
..... mm

(Total 2 marks)

Q10

2



Leave blank

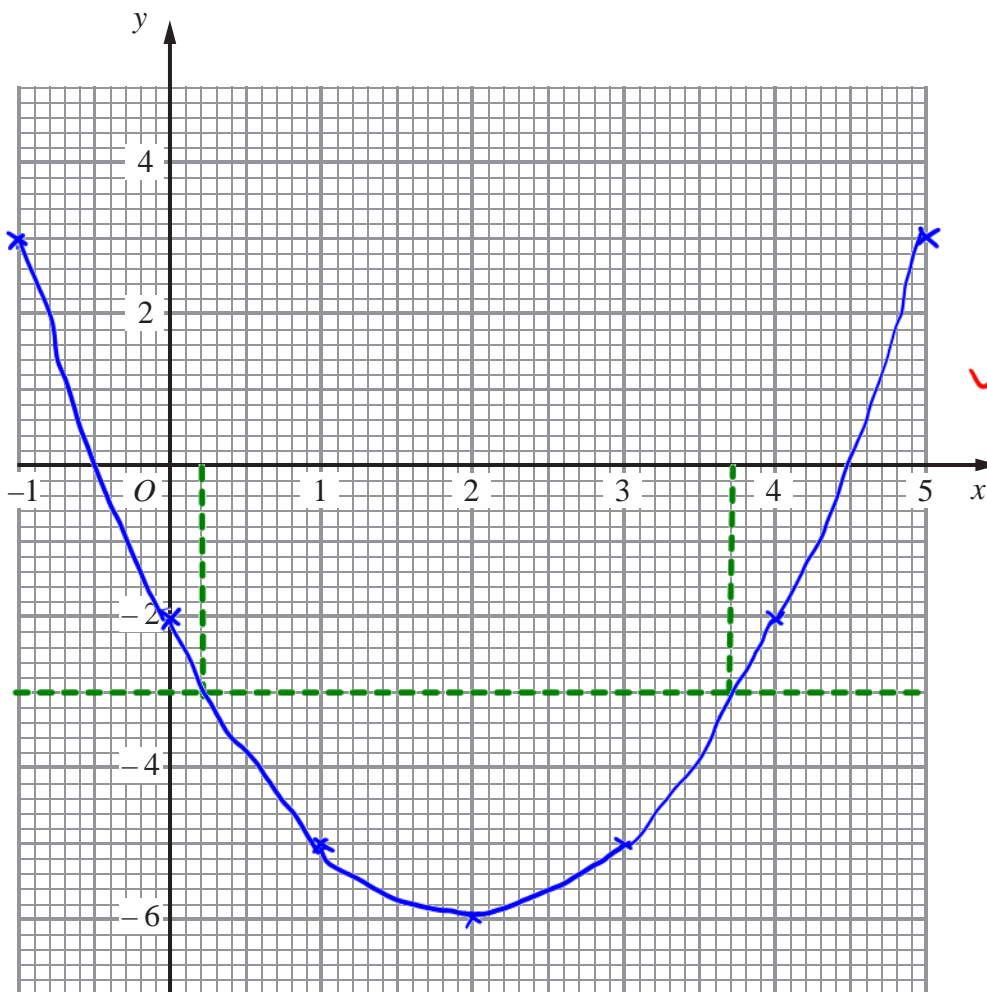
11. (a) Complete the table of values for  $y = x^2 - 4x - 2$

|       |     |    |    |      |      |     |     |
|-------|-----|----|----|------|------|-----|-----|
| x     | -1  | 0  | 1  | 2    | 3    | 4   | 5   |
| y     | 3 ✓ | -2 | -5 | -6 ✓ | -5 ✓ | -2  | 3   |
| $x^2$ | 1   | 0  | 1  | 4    | 9    | 16  | 25  |
| $-4x$ | 4   | 0  | -4 | -8   | -12  | -16 | -20 |
| $-2$  | -2  | -2 | -2 | -2   | -2   | -2  | -2  |

(2)

2

(b) On the grid, draw the graph of  $y = x^2 - 4x - 2$



✓

2

(2)

(c) Use your graph to estimate the values of  $x$  when  $y = -3$

0.2 - 0.4  
 0.2 ✓  
 $x = \dots\dots\dots$   
 3.7 ✓  
 $x = \dots\dots\dots$   
 3.6 - 3.8 (2)

2

(Total 6 marks)

Q11  
6



12. (a) Draw the locus of all points which are equidistant from the points  $A$  and  $B$ .

$A \times$

$\times B$

(2)

(b) Draw the locus of all points that are exactly 3 cm from the line  $PQ$ .

$P$

$Q$

(2)

Q12

(Total 4 marks)



Leave  
blank

13. Find the Lowest Common Multiple (LCM) of 24 and 36

$$24, 48, 72$$

$$36, 72$$

$$72 \checkmark$$

(Total 2 marks)

Q13

2

14. (a) Expand and simplify  $3(x + 4) + 5(2x + 1)$ 

$$3(x + 4) + 5(2x + 1)$$

$$= 3x + 12 + 10x + 5$$

$$= 13x + 17$$

$$13x + 17 \checkmark$$

(2)

2

(b) Simplify  $t^4 \times t^6$ 

$$t^4 \times t^6 = t^{4+6} = t^{10}$$

$$t^{10} \checkmark$$

(1)

1

(c) Simplify  $p^8 \div p^5$ 

$$p^8 \div p^5 = p^{8-5} = p^3$$

$$p^3 \checkmark$$

(1)

1

(d) Simplify  $(x^4)^3$ 

$$(x^4)^3 = x^{4 \times 3} = x^{12}$$

$$x^{12} \checkmark$$

(1)

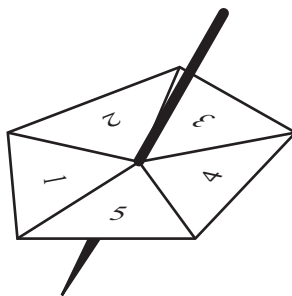
Q14

5

(Total 5 marks)



15. Here is a 5-sided spinner.



The sides of the spinner are labelled 1, 2, 3, 4 and 5

The spinner is biased.

The probability that the spinner will land on each of the numbers 1, 2, 3 and 4 is given in the table.

|             |      |      |     |      |     |
|-------------|------|------|-----|------|-----|
| Number      | 1    | 2    | 3   | 4    | 5   |
| Probability | 0.15 | 0.05 | 0.2 | 0.25 | $x$ |

Work out the value of  $x$ .

$$\begin{array}{r}
 0.15 \\
 0.05 \\
 0.20 \\
 0.25 \\
 \hline
 0.65 \\
 1
 \end{array}$$

$$\begin{aligned}
 x &= 1 - 0.65 \\
 &= 0.35
 \end{aligned}$$

$$x = 0.35 \checkmark$$

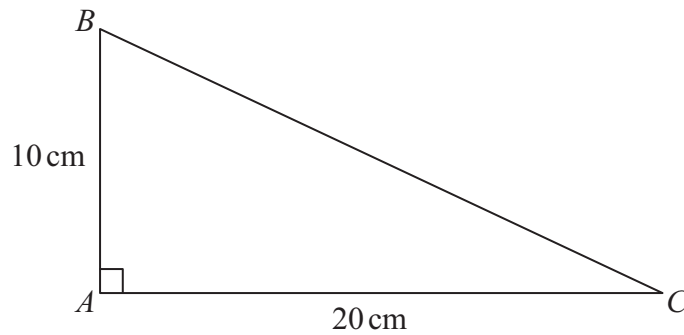
Q15

2

(Total 2 marks)



16.

Diagram NOT  
accurately drawnIn triangle  $ABC$ ,

$$AB = 10 \text{ cm}$$

$$AC = 20 \text{ cm}$$

$$\text{angle } BAC = 90^\circ$$

Work out the length of  $BC$ .

Give your answer correct to 3 significant figures.

You must state the units in your answer.

PYTHAGORAS

$$c^2 = a^2 + b^2$$

$$c^2 = 10^2 + 20^2$$

$$c^2 = 100 + 400$$

$$c^2 = 500$$

$$c = \sqrt{500}$$
$$= 22.4$$

22.4

cm

(Total 4 marks)

Q16

4



17. Majid carried out a survey of the number of school dinners 32 students had in one week.

The table shows this information.

| Number of school dinners | Frequency | $fx$ |
|--------------------------|-----------|------|
| 0                        | 0         | 0    |
| 1                        | 8         | 8    |
| 2                        | 12        | 24   |
| 3                        | 6         | 18   |
| 4                        | 4         | 16   |
| 5                        | 2         | 10   |

Calculate the mean.

TOTAL                      32                      76

$$\text{Mean} = \frac{\sum fx}{\sum f} = \frac{76}{32} = 2.375$$

2.375 ✓

(Total 3 marks)

Q17

3

18. The value of a car depreciates by 35% each year.

At the end of 2007 the value of the car was £5460

Work out the value of the car at the end of 2006

REVERSE PERCENTAGE

$$2006 \text{ PRICE} \times 0.65 = 5460$$

$$\therefore 2006 \text{ PRICE} = \frac{5460}{0.65} = \underline{8400}$$

$$35\% = 0.35$$

$$\text{multiplier} = 1 - 0.35$$

$$= 0.65$$

£ 8400 ✓

(Total 3 marks)

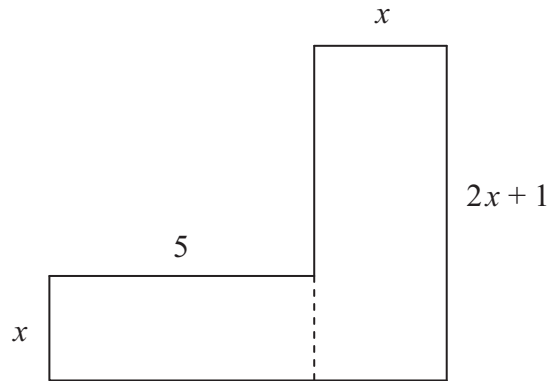
Q18

3



19. The diagram below shows a 6-sided shape.  
All the corners are right angles.  
All the measurements are given in centimetres.

Diagram **NOT**  
accurately drawn



The area of the shape is  $95 \text{ cm}^2$ .

- (a) Show that  $2x^2 + 6x - 95 = 0$

$$\text{Area} = 5x + x(2x + 1) = 95$$

$$5x + 2x^2 + x = 95$$

$$2x^2 + 6x - 95 = 0 \quad \checkmark$$

(3)

- (b) Solve the equation

$$2x^2 + 6x - 95 = 0$$

Give your solutions correct to 3 significant figures.

use Quadratic  
Formula!

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-6 \pm \sqrt{36 - (4 \times 2 \times -95)}}{4}$$

$$a = 2$$

$$b = 6$$

$$c = -95$$

$$= \frac{-6 \pm \sqrt{796}}{4}$$

$$x = 5.55 \quad \checkmark \quad \text{or } x = -8.55 \quad \checkmark$$

(3)

Q19

(Total 6 marks)

6





20. The  $n$ th even number is  $2n$ .

The next even number after  $2n$  is  $2n + 2$

(a) Explain why.

Because the sequence of even numbers  
has a gap of 2 between each term in  
the sequence. (1)

(b) Write down an expression, in terms of  $n$ , for the next even number after  $2n + 2$

$2n + 4$  (1)

(c) Show algebraically that the sum of any 3 consecutive even numbers  
is always a multiple of 6

$2n + 2n + 2 + 2n + 4$   
 $= 6n + 6$   
 $= 6(n+1)$  (3)

each number in the  
sequence is a multiple of 6

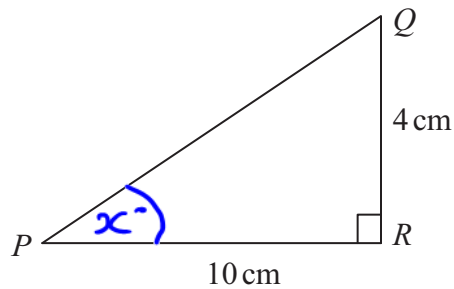
(Total 5 marks)

Q20

5



21.

Diagram NOT  
accurately drawn $PQR$  is a right-angled triangle. $QR = 4 \text{ cm}$   
 $PR = 10 \text{ cm}$ SOHCAHTOA  
use tanWork out the size of angle  $RPQ$ .

Give your answer correct to 3 significant figures.

$$\tan x^\circ = \frac{4}{10}$$

$$x^\circ = \tan^{-1}\left(\frac{4}{10}\right)$$

$$= 21.80140949$$

$$= 21.8$$

21.8 ✓

(Total 3 marks)

Q21

3

22.  $D$  is proportional to  $S^2$ . $D = 900$  when  $S = 20$ Calculate the value of  $D$  when  $S = 25$ 

$$D \propto S^2$$

$$D = kS^2$$

$$900 = k \times 20^2$$

$$900 = 400k$$

$$k = \frac{900}{400} = \frac{9}{4} = 2.25$$

$$D = 2.25 S^2$$

$$= 2.25 \times 25^2$$

$$= 2.25 \times 625$$

$$= 1406.25$$

$$D = 1406.25$$

(Total 4 marks)

Q22

4



23. A ball is thrown vertically upwards with a speed  $V$  metres per second.

The height,  $H$  metres, to which it rises is given by

$$H = \frac{V^2}{2g}$$

where  $g \text{ m/s}^2$  is the acceleration due to gravity.

$V = 24.4$  correct to 3 significant figures.

$g = 9.8$  correct to 2 significant figures.

(i) Write down the lower bound of  $g$ .

9.7      9.8      9.9  
           ↑  
       9.75

9.75 ✓  
 .....

(ii) Calculate the upper bound of  $H$ .

Give your answer correct to 3 significant figures.

$$\text{UB of } H = \frac{\text{UB of } v^2}{\text{LB of } 2g} = \frac{24.45^2}{2 \times 9.75}$$

$$\text{UB of } v = 24.45$$

.....  
 Q23

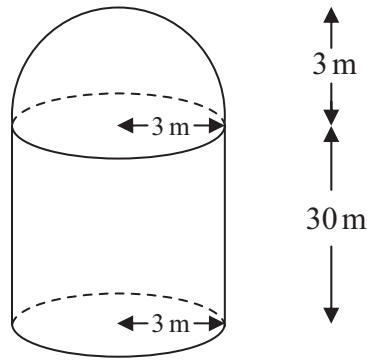
(Total 3 marks)



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24. The diagram shows a storage tank.

Diagram **NOT** accurately drawn



The storage tank consists of a hemisphere on top of a cylinder.

The height of the cylinder is 30 metres.

The radius of the cylinder is 3 metres.

The radius of the hemisphere is 3 metres.

- (a) Calculate the total volume of the storage tank.  
Give your answer correct to 3 significant figures.

..... m<sup>3</sup>  
(3)

A sphere has a volume of 500 m<sup>3</sup>.

- (b) Calculate the radius of the sphere.  
Give your answer correct to 3 significant figures.

..... m  
(3)

(Total 6 marks)

Q24



25.

|             | Male | Female |
|-------------|------|--------|
| First year  | 399  | 602    |
| Second year | 252  | 198    |

The table gives information about the numbers of students in the two years of a college course.

Anna wants to interview some of these students.

She takes a random sample of 70 students stratified by year and by gender.

Work out the number of students in the sample who are male and in the first year.

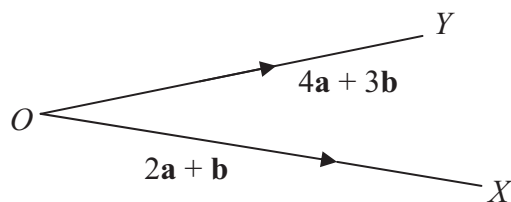
.....

Q25

(Total 3 marks)



26.

Diagram **NOT**  
accurately drawn

$$\overrightarrow{OX} = 2\mathbf{a} + \mathbf{b}$$

$$\overrightarrow{OY} = 4\mathbf{a} + 3\mathbf{b}$$

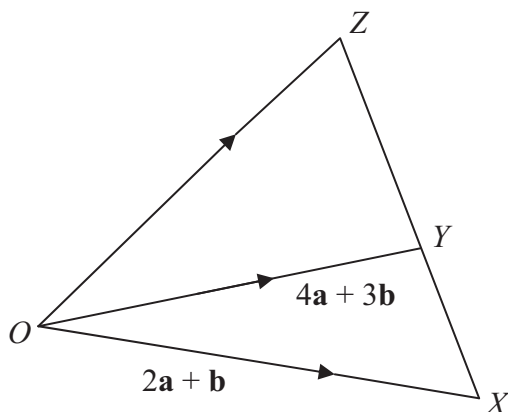
- (a) Express the vector  $\overrightarrow{XY}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$   
Give your answer in its simplest form.

.....  
(2)



Leave blank

Diagram **NOT** accurately drawn



$XYZ$  is a straight line.  
 $XY : YZ = 2 : 3$

- (b) Express the vector  $\vec{OZ}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$   
 Give your answer in its simplest form.

.....

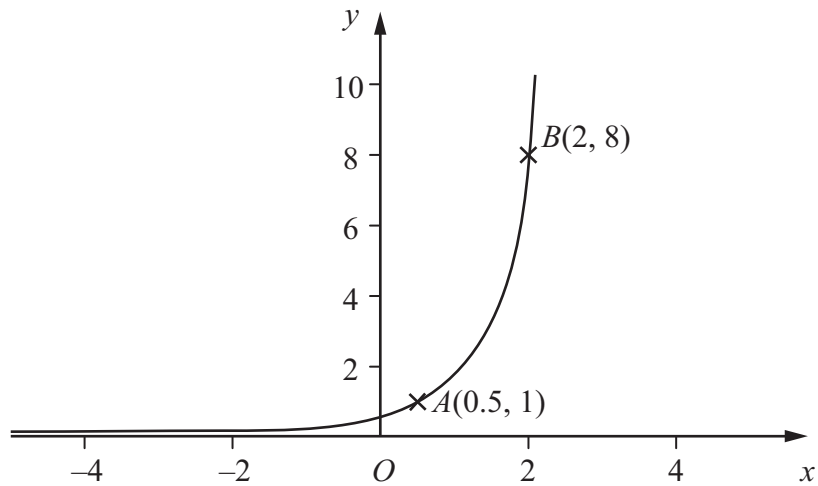
(3)

Q26

(Total 5 marks)



27.



The diagram shows a sketch of the graph  $y = ab^x$   
 The curve passes through the points  $A(0.5, 1)$  and  $B(2, 8)$ .

The point  $C(-0.5, k)$  lies on the curve.

Find the value of  $k$ .

.....

(Total 4 marks)

Q27

**TOTAL FOR PAPER: 100 MARKS**

**END**

