| Candidate No. | | | | | | **1** | **3** | **8** | **0** | **/** | **3** | **H** | Signature M. Semar |

1380/3H

Edexcel GCSE

Mathematics (Linear) – 1380

Paper 3 (Non-Calculator)

Higher Tier

Friday 2 March 2012 – Afternoon

Time: 1 hour 45 minutes

Examiner's use only

Team Leader's use only

Materials required for examination	**Items included with question papers**
Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser. Tracing paper may be used.	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 24 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 must not be used.

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.

P 4 0 6 3 2 A 0 1 2 4

Turn over

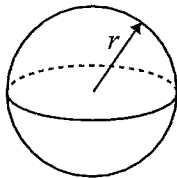**PEARSON**

Formulae – Higher Tier

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

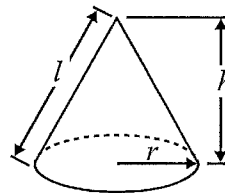**Volume of prism** = area of cross section × length
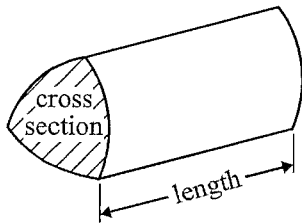
Volume of sphere $= \frac{4}{3}\pi r^3$
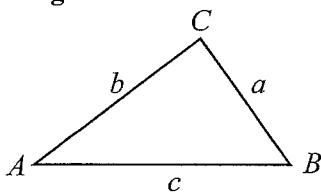
Surface area of sphere $= 4\pi r^2$

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

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

In any triangle ABC

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

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

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

P 4 0 6 3 2 A 0 2 2 4

Answer ALL TWENTY FOUR questions.

Write your answers in the spaces provided.

You must write down all stages in your workings.

You must NOT use a calculator.

1. (a) Simplify $2a + 3b - a - b$

$2a - a + 3b - b$

$\underline{ a + 2b }$
(2)

(b) Expand $4(2m - 3n)$

$4 \times 2m - 4 \times 3n$

$\underline{ 8m - 12n }$
(1)   **Q1**

(Total 3 marks)

2. Work out an estimate for the value of
    Give your answer as a decimal.

$$\frac{60.2 \times 0.799}{223}$$

$60.2 = 60 \, (1sf)$
$0.799 = 0.8 \, (1sf)$
$223 = 200 \, (1sf)$

$$\frac{60 \times 0.8}{200} = \frac{6 \times 8}{200} = \frac{48}{200} = \frac{24}{100}$$

$\underline{ 0.24 }$ **Q2**

(Total 3 marks)

3. Fred buys 18 tins of polish costing £2.37 each.

(a) Work out the total cost.

$$\begin{array}{r} 2.37 \\ \times \quad 18 \\ \hline = \ 1896 \\ 237 \\ \hline 42.66 \end{array}$$

£ .....42.66.....

(3)

A vacuum cleaner costs £85
Fred gets 10% off the price of the vacuum cleaner.

(b) Work out how much he has to pay.

Reduction = 10% of £85

= 85 ÷ 10 = £8.50

He pays : 85 − 8.50

£ .....76.50.....

(3)

Q3

(Total 6 marks)
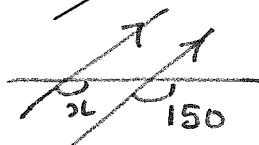
4.

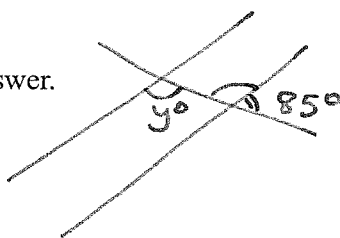Diagram **NOT** accurately drawn

$x°$

$150°$

$85°$
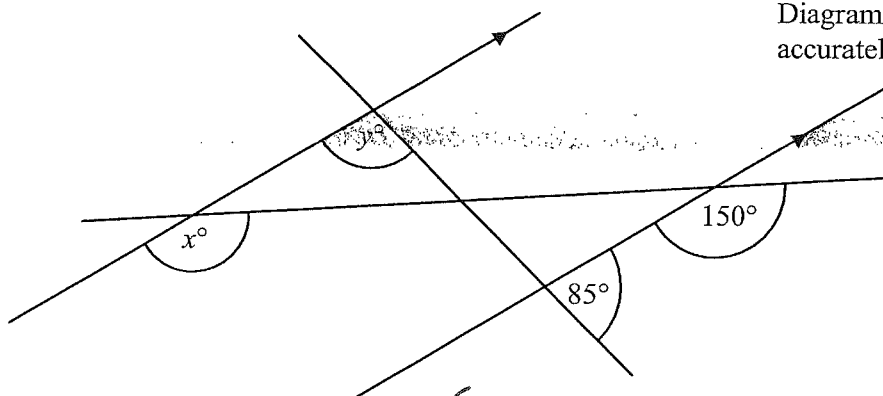
(a) Find the value of x.

~Corresponding angles are equal.

$150°$

(1)

(b) Find the value of y.
Give reasons for your answer.

$y°$ $85°$

$y = 180 - 85 = 95°$

• Alternate angles are =
• Angles on straight line
  add up to $180°$

$95°$

(2)

(Total 3 marks)

Q4

P 4 0 6 3 2 A 0 5 2 4

5. There are only red counters, blue counters and green counters in a bag.
    There are 5 red counters.
    There are 6 blue counters.
    There is 1 green counter.

    Jim takes at random a counter from the bag.

    (a) Work out the probability that Jim takes a counter that is **not** red.

$$P(\text{red}) + P(\text{not red}) = 1$$
$$P(\text{not red}) = 1 - P(\text{red})$$
$$= 1 - \frac{5}{12}$$

$$\frac{7}{12}$$

(2)

Jim puts the counter back in the bag.
He then puts some more green counters into the bag.

The probability of taking at random a red counter is now $\frac{1}{3}$

(b) Work out the number of green counters that are now in the bag.

$$P(\text{red}) = \frac{1}{3} = \frac{5}{x} \qquad (x = \text{total number of counters})$$
$$= \frac{1}{3} = \frac{5}{15} \qquad (x = 15).$$
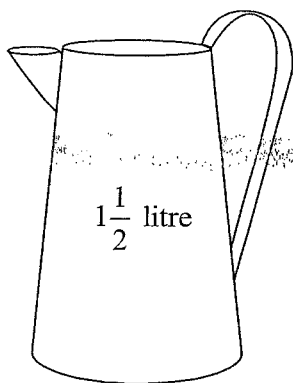
Green Counters $= 15 - 5 - 6 = 4$

4 green

(2)   Q5

(Total 4 marks)

6.

$1\frac{1}{2}$ litre

There are $1\frac{1}{2}$ litres of juice in a jug.

$(1\ell = 1000\text{ ml})$.

Lisa is going to pour the juice into some glasses.
She will fill each glass with 175 ml of juice.

Work out the greatest number of glasses she can fill.

$1\frac{1}{2}$ litre $= 1.5 \ell = 1500$ ml

Number of glasses $= 1500 \div 175$

$$175 \overline{\smash{)}1500}\ \ \overset{8}{} \qquad r = 100\text{ ml}$$

.... 8 glasses

(Total 4 marks)

P 4 0 6 3 2 A 0 7 2 4

7. Jo measured the times in seconds it took 18 students to run 400 m.
   Here are the times.

67	78	79	98	96	103
75	85	94	92	61	80
82	86	90	95	90	89

   (a) Draw an ordered stem and leaf diagram to show this information.

6	1 7
7	5 8 9
8	0 2 5 6 9
9	0 0 2 4 5 6 8
10	3

   ⌐ Median

   Key:
   7 | 5 = 75 seconds —

   (3)

   (b) Work out the median.

   Median given by $\frac{18+1}{2} = 9.5^{th}$ value.

   $M = \frac{86+89}{2} = 87.5$

   .... 87.5 seconds

   (2)

   (Total 5 marks)

Q7

8. (a) Solve $13x + 1 = 11x + 8$

$$13x - 11x + 1 = 11x - 11x + 8$$
$$2x + 1 = 8$$
$$2x + 1 - 1 = 8 - 1$$
$$2x = 7$$

$x = \dfrac{7}{2} = 3.5$

(2)

(b) Show that $y = -2$ is a solution of the equation $\dfrac{4}{y} + y = 2y$

$$\frac{4}{-2} + -2 = 2x - 2 \; .$$
$$-2 - 2 = -4$$
$$-4 = -4 \quad \therefore \; y = -2 \text{ is a}$$
$$\checkmark \qquad \checkmark \qquad \text{solution to}$$
$$\text{the equation .}$$

(2) **Q8**

(Total 4 marks)

---

9. Sweets are sold in bags and in tins.

There are 20 sweets in a bag.
There are 30 sweets in a tin.

Lee buys B bags of sweets and T tins of sweets.

He buys a total of S sweets.
Write down a formula for S in terms of B and T.

• In B bags there are $20B$ sweets.
◦ In T tins there are $30T$ sweets.

$$S = 20B + 30T$$

$\underline{20B + 30T}$ **Q9**

(Total 3 marks)

10. Jim has only 5p coins and 10p coins.

The ratio of the number of 5p coins to the number of 10p coins is 2 : 3

Work out the ratio of

the total value of the 5p coins : the total value of the 10p coins.

Give your answer in its simplest form.

Ratio of total value:

$2 \times 5 \quad : \quad 3 \times 10$

$10 : 30$

$1 : 3$

.... $1 : 3$ ....

(Total 2 marks)

Q10

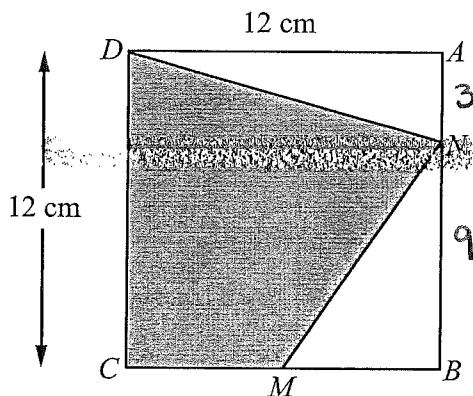P 4 0 6 3 2 A 0 1 0 2 4

11.

12 cm

Diagram **NOT**
accurately drawn

12 cm

ABCD is a square of side 12 cm.
M is the midpoint of *CB*.
N is a point on *AB*.

$AN = \dfrac{1}{4}AB.$

Calculate the area of the shaded region *CDNM*.

$$\cdot\ AN = \tfrac{1}{4}\ AB = \tfrac{1}{4}\times 12 = 3\,cm$$

Triangle ADN : Area $= \dfrac{3\times 12}{2} = 18\,cm^2$.

$$\cdot\ NB = \tfrac{3}{4}\ AB = \tfrac{3}{4}\times 12 = 9\,cm$$

$$\cdot\ MB = BC \div 2 = DA \div 2 = 6\,cm$$

Triangle MBN : Area $= \dfrac{6\times 9}{2} = 27\,cm^2$

Shaded region $=$ Area of square $-$ Are of $\triangle$ $-$ Area of $\triangle$
DABC   ADN   NMB

$$= (12\times 12) - 18 - 27$$

$$= 144 - 18 - 27$$

.............99............ cm² **Q11**

(Total 6 marks)

P 4 0 6 3 2 A 0 1 1 2 4

Turn over

12. The table gives information about the lengths of the branches on a bush.

Length (L cm)	Frequency
$0 \leqslant L < 10$	20
$10 \leqslant L < 20$	12
$20 \leqslant L < 30$	10
$30 \leqslant L < 40$	8
$40 \leqslant L < 50$	6
$50 \leqslant L < 60$	0

(a) Draw a frequency polygon to show this information.

Frequency

Length (L cm)
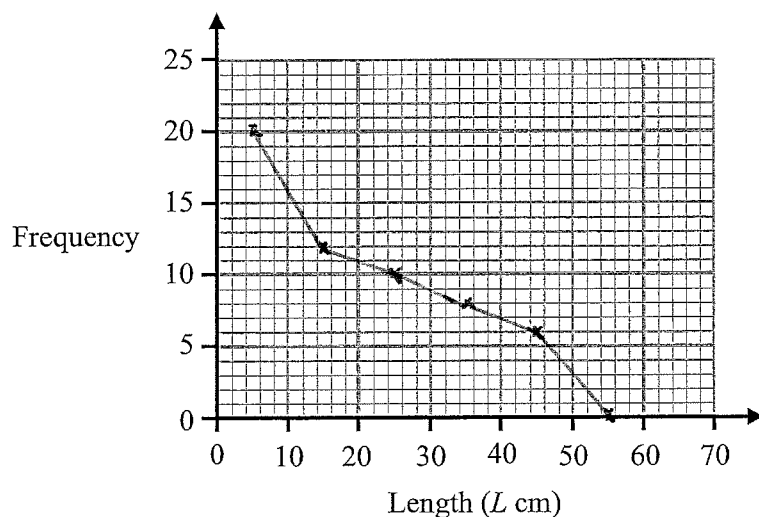
(2)

(b) Write down the modal class interval.

Given by highest Frequency.
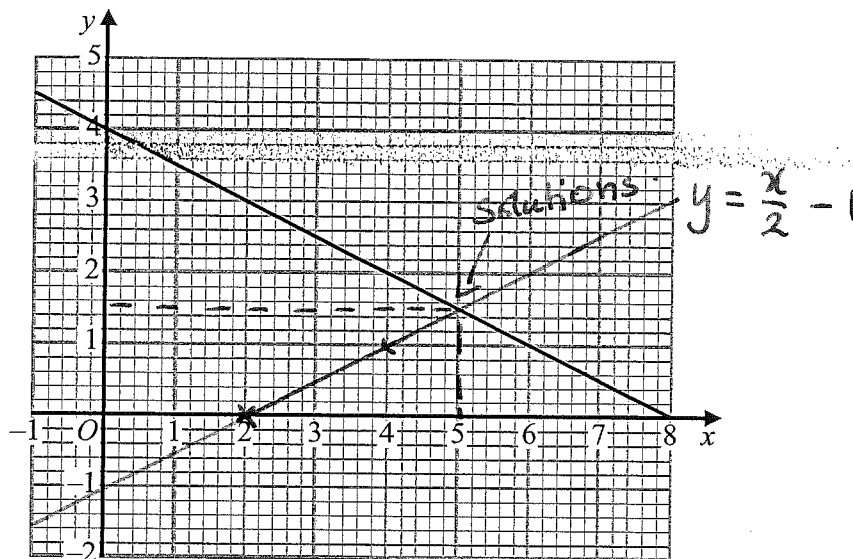
$0 \leqslant L < 10$

(1)

Q12

(Total 3 marks)

13.

$y = \frac{x}{2} - 1$

The graph of the straight line $x + 2y = 8$ is shown on the grid.

(a) On the grid, draw the graph of $y = \frac{x}{2} - 1$

x	0	2	4
y	$\frac{0}{2} - 1 = -1$	$\frac{2}{2} - 1 = 0$	1

$(0; -1)$
$(2; 0)$.
$(4; 1)$.

(3)

(b) Use the graphs to find estimates for the solution of

$x + 2y = 8$

$y = \frac{x}{2} - 1$

$x = $ ....5....... $y = $ .....1·5.....

(1) Q13

(Total 4 marks)

14. (a) Write 6.43×10^5 as an ordinary number.

6.43⌣⌣⌣

643000

(1)

(b) Work out the value of $2 \times 10^7 \times 8 \times 10^{-12}$
Give your answer in standard form.

$2 \times 8 \times 10^7 \times 10^{-12}$

16×10^{-5}

$1.6 \times 10^1 \times 10^{-5}$

1.6×10^{-4}

(2)

Q14

(Total 3 marks)

15. (a) Factorise fully $2x^2 - 4xy$

$2 \times x \times x - 2 \times 2 \times x \times y$

$2x(x - 2y)$

$2x(x - 2y)$

(2)

(b) Factorise $p^2 - 6p + 8$ $= (x-4)(x-2)$

$? + ? = -6$
$? \times ? = 8$

$-4; -2$

$(x-4)(x-2)$

(2)

(c) Simplify $\dfrac{(x+2)^2}{x+2}$ $= \dfrac{(x+2)(x+2)}{(x+2)}$

$x+2$

(1)

(d) Simplify $2a^2b \times 3a^3b$

$2 \times 3 \times a^2 \times a^3 \times b \times b$

$6a^5b^2$

(2)

Q15

(Total 7 marks)

16. All the students in Mathstown school had a test.
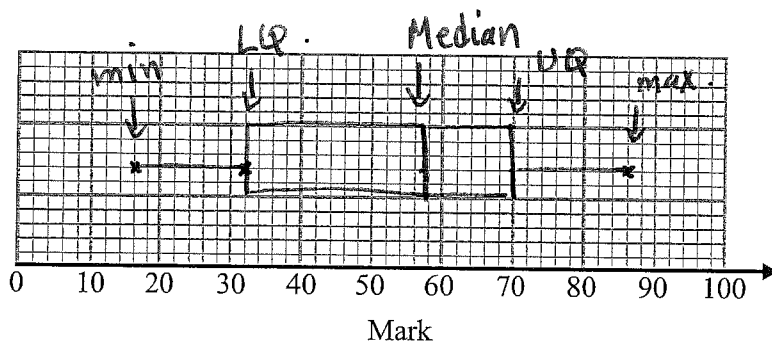
The lowest mark was 18
The highest mark was 86
The median was 57
The lower quartile was 32
The interquartile range was 38   Upper quartile = 38 + 32 = 70

On the grid, draw a box plot to show this information.
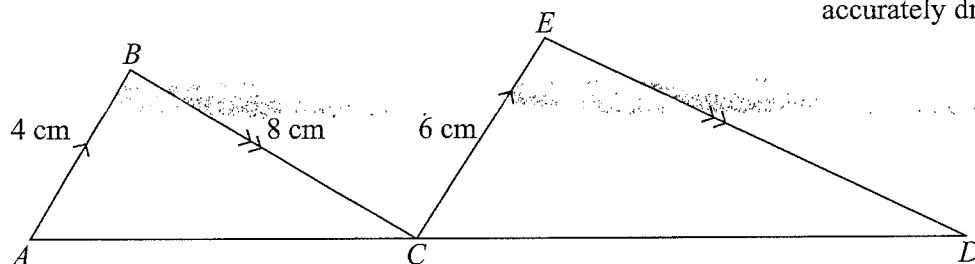

Mark

Q16

(Total 3 marks)

P 4 0 6 3 2 A 0 1 5 2 4

17.

Diagram **NOT** accurately drawn

ACD is a straight line.
AB is parallel to *CE*.
BC is parallel to *ED*.

AB = 4 cm.
CE = 6 cm.
BC = 8 cm.

$$\text{Scale factor} = \frac{6}{4} = \frac{3}{2}.$$

(a) Calculate the length of *ED*.

$$ED = \frac{3}{2} \times 8 = 12$$

.................12................. cm

(2)

AD = 25 cm.

(b) Calculate the length of *AC*.

AC : CD

=

2 : 3

$25 \div 5 = 5$ (1 part)

$AC = 2 \times 5 = 10$

$CD = 3 \times 5 = 15$

.................10................. cm

(2)

Q17

(Total 4 marks)

16

18. There are only red marbles and green marbles in a bag.
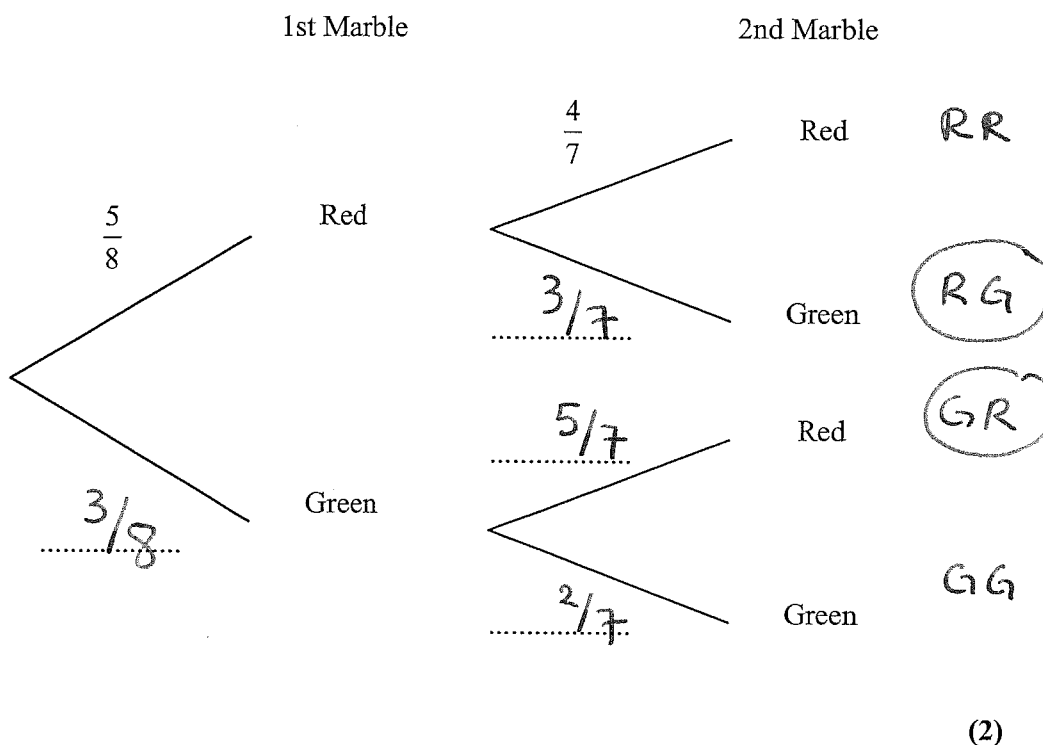There are 5 red marbles and 3 green marbles.

Dwayne takes at random a marble from the bag.
~~He does not put the marble back in the bag.~~ *does not put marble back in the bag.*

Dwayne takes at random a second marble from the bag.

(a) Complete the probability tree diagram.

1st Marble   2nd Marble

$\frac{5}{8}$ Red

$\frac{4}{7}$ Red   RR

$\frac{3}{7}$ Green   (RG)

$\frac{3}{8}$ Green

$\frac{5}{7}$ Red   (GR)

$\frac{2}{7}$ Green   GG

(2)

(b) Work out the probability that Dwayne takes marbles of different colours.

Different colors : RG or GR.

$$\frac{5}{8} \times \frac{3}{7} + \frac{3}{8} \times \frac{5}{7}$$

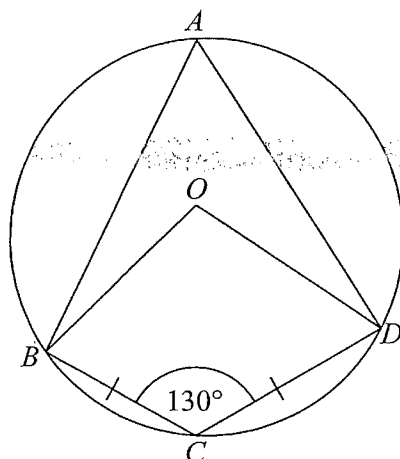$$\frac{15}{56} + \frac{15}{56} = \frac{30}{56}$$

30/56

(3)   Q18

(Total 5 marks)

19.

Diagram **NOT** accurately drawn

A, B, C and D are points on a circle, centre O.
$BC = CD$.
Angle $BCD = 130°$.

(a) Write down the size of angle BAD.
   Give a reason for your answer.

$\angle BAD = 180 - 130 = 50°$

ABCD is a cyclic quadrilateral
opposite angles add up to $180°$

.... 50 °

(2)

(b) Work out the size of angle ODC.
   Give reasons for your answer.

$\angle BOD = 2 \angle BAD = 2 \times 50 = 100°$.

In the Quadrilateral OBCD :

$\angle OBC = \angle ODC = \dfrac{360 - (130 + 100)}{2}$.

$\angle ODC = \dfrac{360 - 230}{2} = 65°$

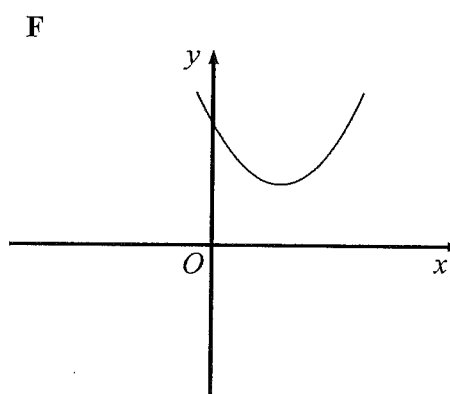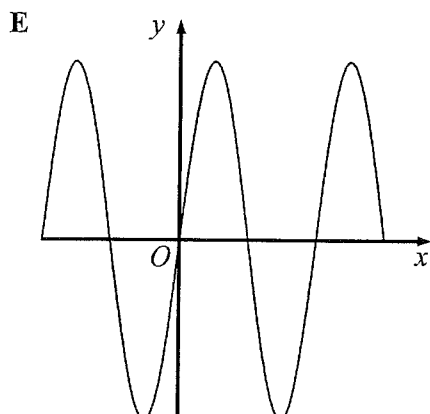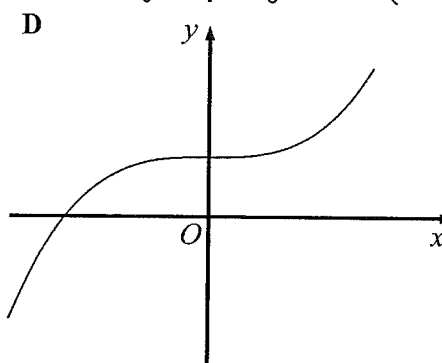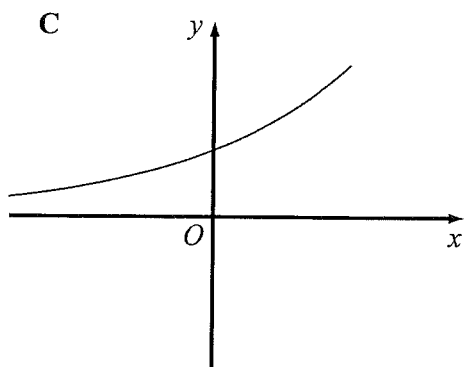.................................... 65 °

(4)

(Total 6 marks)

Q19

P 4 0 6 3 2 A 0 1 8 2 4

20.

A

B

C

D

E

F
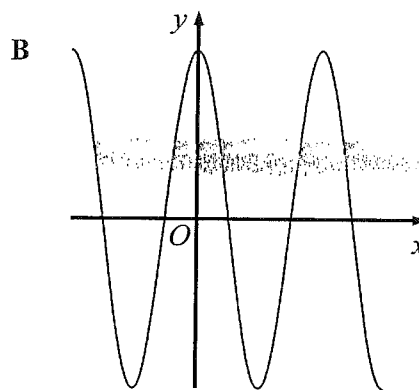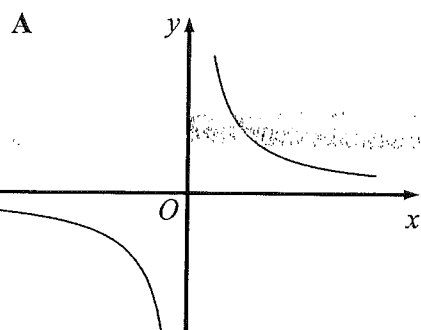
Each equation in the table represents one of the graphs **A** to **F**.

Write the letter of each graph in the correct place in the table.

Equation	Graph
$y = 4 \sin x°$	E
$y = 4 \cos x°$	B
$y = x^2 - 4x + 5$	F
$y = 4 \times 2^x$	C
$y = x^3 + 4$	D
$y = \dfrac{4}{x}$	A

(Total 3 marks)

Q20

Turn over

21. Here is a shape *ABCDE*.
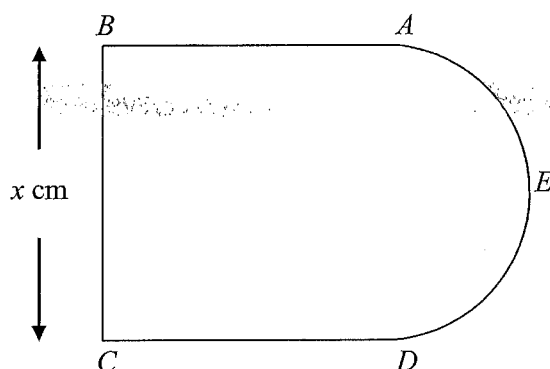
AB, *BC* and *CD* are three sides of a square.
BC = *x* cm.
AED is a semicircle with diameter *AD*.

The perimeter, *P* cm, of the shape *ABCDE* is given by the formula

$$P = 3x + \frac{\pi x}{2}$$

(a) Rearrange this formula to make *x* the subject.

$$3x + \frac{\pi x}{2} = P$$

$$\frac{3 \times 2}{2}x + \frac{\pi}{2}x = P$$

$$\frac{6}{2}x + \frac{\pi}{2}x = P$$

$$\frac{1}{2}x(6 + \pi) = P$$
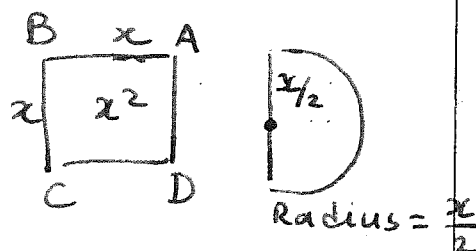
$$x(6 + \pi) = 2P$$

$$x = \frac{2P}{6 + \pi}$$

Or $x = \dfrac{P}{\left(3 + \pi/2\right)}$

$$x = \frac{2P}{(6 + \pi)}$$

(2)

The area, A cm², of this shape is given by $A = kx^2$ where k is a constant.

(b) Find the exact value of k.
Give your answer in its simplest form.

$B \quad x \quad A$

$x \quad \boxed{x^2} \quad$

$C \quad D$

Radius $= \dfrac{x}{2}$

$k = \dfrac{A}{x^2}$

$A =$ area of square + area of semi-circle

$\left(\frac{1}{2}\pi r^2\right)$

$= x^2 + \dfrac{1}{2}\pi\left(\dfrac{x}{2}\right)^2$

$= x^2 + \dfrac{1}{2}\pi\,\dfrac{1}{4}x^2$

$= x^2 + \dfrac{1}{8}\pi x^2$

$= x^2\left(1 + \dfrac{\pi}{8}\right) \qquad \therefore k = 1 + \dfrac{\pi}{8}$

$\underbrace{\qquad}_{k}$

....

(3) **Q21**

(Total 5 marks)

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22. Expand and simplify $\left(2+\sqrt{2}\right)\left(3+\sqrt{8}\right)$

Give your answer in the form $a + b\sqrt{2}$ where a and b are integers.

$2 \times 3 + 2 \times \sqrt{8} + 3 \times \sqrt{2} + \sqrt{2} \times \sqrt{8}$

$6 + 2\sqrt{8} + 3\sqrt{2} + \sqrt{16}$

• $\sqrt{8} = \sqrt{2 \times 4} = 2\sqrt{2}$ This means $2\sqrt{8} = 2 \times 2\sqrt{2}$

$= 4\sqrt{2}$

• $\sqrt{16} = 4$

$6 + 4\sqrt{2} + 3\sqrt{2} + 4$
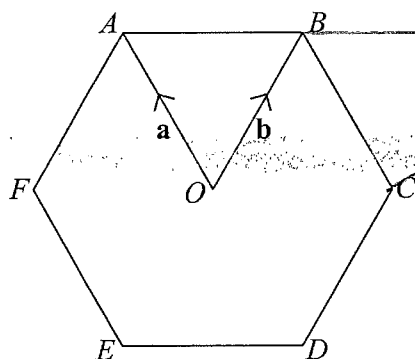
$10 + 7\sqrt{2}$

$a = 10$

$b = 7$

$10 + 7\sqrt{2}$

....

Q22

(Total 4 marks)

P 4 0 6 3 2 A 0 2 1 2 4

23.

ABCDEF is a regular hexagon, with centre O.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$.

$\overrightarrow{AO} = -\overrightarrow{OA}$.

(a) Write the vector $\overrightarrow{AB}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.

$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB} = -a + b$

...........b − a...........

(1)

The line AB is extended to the point K so that AB : BK = 1 : 2

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

$AB : BK$
$1 : 2$ ∴ $\overrightarrow{BK} = 2 \times \overrightarrow{AB}$

$\overrightarrow{BK} = 2 \times (b - a)$

$\overrightarrow{CK} = \overrightarrow{CB} + \overrightarrow{BK}$ ($\overrightarrow{CB} = \overrightarrow{OA} = a$).

$= a + 2(b - a)$

$= a + 2b - 2a$

$= 2b - a$

...........2b − a...........

(3)   Q23
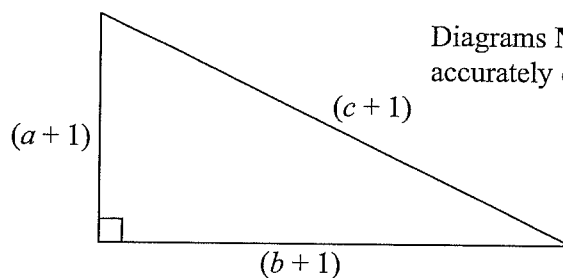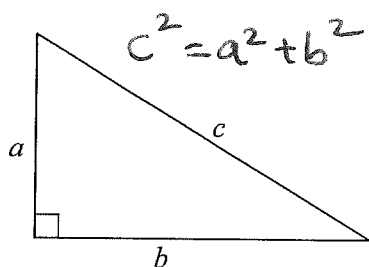
(Total 4 marks)

24. Umar thinks $(a+1)^2 = a^2 + 1$ for all values of a.

(a) Show that Umar is wrong.

$$(a+1)^2 = a^2 + 2a + 1 \neq a^2 + 1$$

(2)

Here are two right-angled triangles.
All the measurements are in centimetres.

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

Diagrams **NOT** accurately drawn

a

c

b

$(a+1)$

$(c+1)$

$(b+1)$

(b) Show that $2a + 2b + 1 = 2c$

$$(c+1)^2 = (a+1)^2 + (b+1)^2 \quad \text{Pythagoras.}$$
$$c^2 + 2c + 1 = a^2 + 2a + 1 + b^2 + 2b + 1$$
$$c^2 + 2c + 1 = a^2 + b^2 + 2a + 2b + 2$$
$$c^2 + 2c + 1 = c^2 + 2a + 2b + 2.$$
$$2c + 1 = 2a + 2b + 2.$$
$$2c = 2a + 2b + 2 - 1$$
$$2c = 2a + 2b + 1$$
$$2a + 2b + 1 = 2c.$$

(3)

a, b and c cannot all be integers.

(c) Explain why.

. $2c$ is always even.

. $2a + 2b + 1$ is always odd

$\therefore a, b, c$ cannot all be integers —

(1)

Q24

(Total 6 marks)

TOTAL FOR PAPER: 100 MARKS

END

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