Edexcel GCSE

Mathematics (Linear) – 1380
Paper 3 (Non-Calculator)

Higher Tier

Friday 2 March 2012 – Afternoon

Time: 1 hour 45 minutes

Materials required for examination
Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser.
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 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.
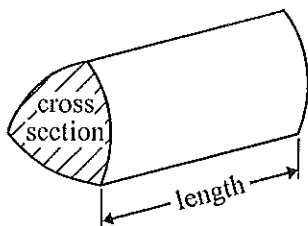Return at the end to those you have left out.

Turn over

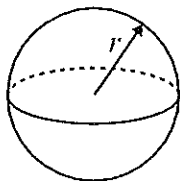PEARSON

Formulae – Higher Tier

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

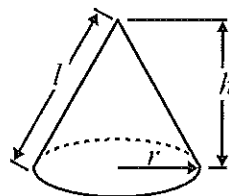**Volume of prism** = area of cross section × length

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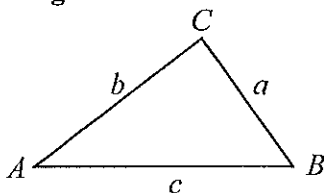
Surface area of sphere $= 4\pi r^2$

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

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

In any triangle *ABC*

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

The Quadratic Equation
The solutions of $ax^2 + bx + c = 0$
where $a \neq 0$, are given by

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

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 working.

You must NOT use a calculator.

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

$$+ 2a - a = +a$$
$$+ 3b - b = + 2b$$

..........$a + 2b$..........

(2)

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

$$4 \times + 2m = 8m$$
$$4 \times - 3n = -12n$$

..........$8m - 12n$..........

(1)

(Total 3 marks)

Q1

2. Work out an estimate for the value of $\dfrac{60.2 \times 0.799}{223}$

Give your answer as a decimal.

Change each number
by rounding to 1 s.f

$$60.2 \rightarrow 60$$
$$0.799 \rightarrow 0.8$$
$$223 \rightarrow 200$$

$$\frac{60 \times 0.8}{200} = \frac{48}{200}$$

$$\frac{48}{200} = \frac{24}{100}$$

..........0.24..........

(Total 3 marks)

Q2

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

(a) Work out the total cost.

18×237

X	200	30	7
10	2000	300	70
8	1600	240	56

2000
1600
300
240
70
+ 56
4266 = 42·66
11

£ ....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.

10% of £85

= 85 ÷ 10 = 8·50

85 − 8·50 = 76·50

85·00
− 8·50
76·50

£ ....76·50....

(3)

Q3

(Total 6 marks)

4.

Diagram **NOT** accurately drawn
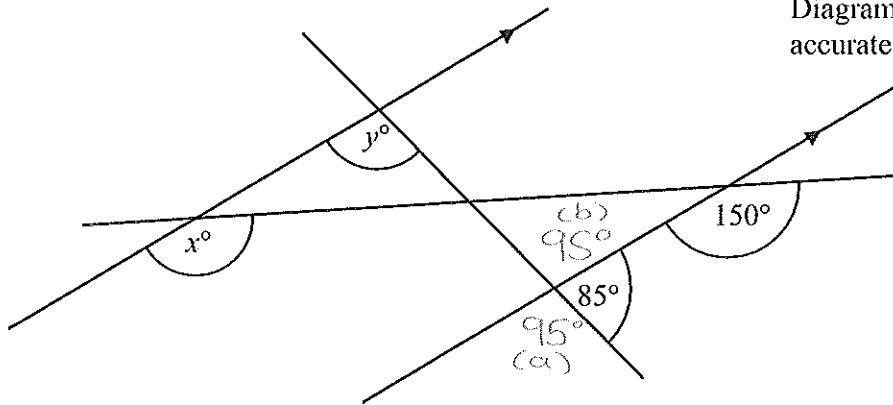
(a) Find the value of x.

x and 150 are corresponding

.................$150°$.................

(1)

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

$180 - 85 = 95°$

(a) Angles in a straight line $= 180$ and corresponding angles are equal

or

(b) Angles in a straight line $= 180$ and alternate angles are equal

.................$95°$.................

(2)

Q4

(Total 3 marks)

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.

$$\frac{\text{Number of not red}}{\text{Total counters}} = \frac{6 + 1}{5 + 6 + 1} = \frac{7}{12}$$

.............$\frac{7}{12}$...............
(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.

Red : $5 = \frac{1}{3}$ of 15

15 counters needed
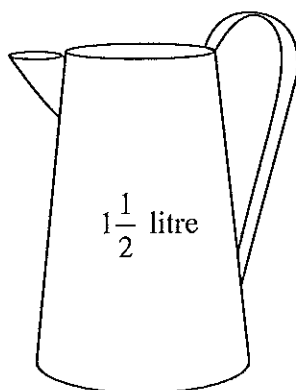
$15 - 12 = 3$ extra green added

Total green $= 1 + 3 = 4$

.............4...............
(2)

(Total 4 marks)

Q5

6.

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

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

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.

$1\frac{1}{2}$ L = 1500 ml

1500 ÷ 175 = $8\frac{4}{7}$

greatest number of filled glasses = 8

.............8.............

(Total 4 marks)

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

$13x + 1 = +11x + 8$
$-11x \qquad -11x$

$2x + 1 = +8$
$\qquad -1 \quad -1$

$2x = 7$

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

$x = $ ......3.5...........

(2)

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

Substitute $y = -2$ into both sides then compare

LHS: $\dfrac{4}{-2} - 2 = -2 - 2 = -4$

RHS: $2 \times -2 = -4$

LHS = RHS = -4

(2) Q8

(Total 4 marks)

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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.

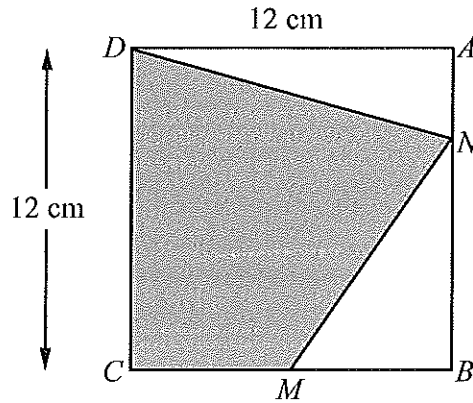$S = 20B + 30T$

$S = 20B + 30T$ Q9

(Total 3 marks)

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*.

$AN = 12 \div 4 = 3cm \quad BN = 12 - 3 = 9cm$

$MB = 12 \div 2 = 6cm$

$\text{Total area (ABCD)} = 12 \times 12 = 144$

$\text{Area of ADN} = \dfrac{12 \times 3}{2} = 18$

$\text{Area of MNB} = \dfrac{6 \times 9}{2} = 27$

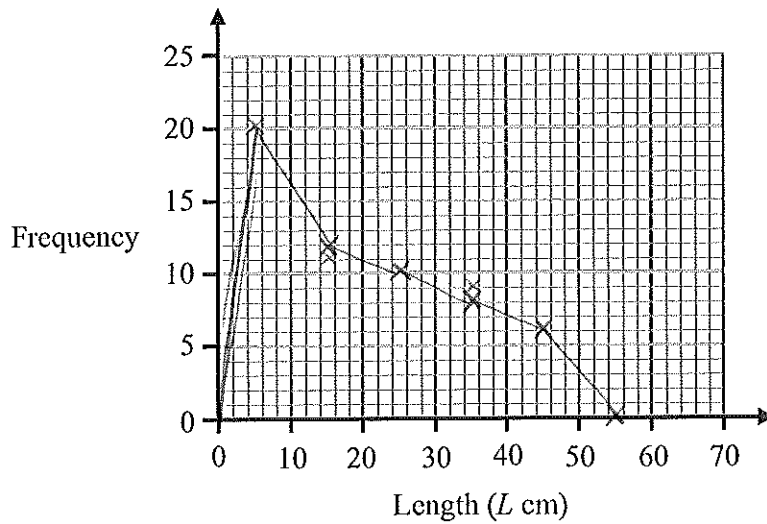$\begin{array}{r} 144 \\ -\ 18 \\ -\ 27 \\ \hline 99 \end{array}$

.................99........... cm²

Q11

(Total 6 marks)

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

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

mid points ← plot these, not the end points

5
15
25
35
45
55

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

(2)

(b) Write down the modal class interval.

modal = largest frequency = 20

= 0 ≤ L < 10
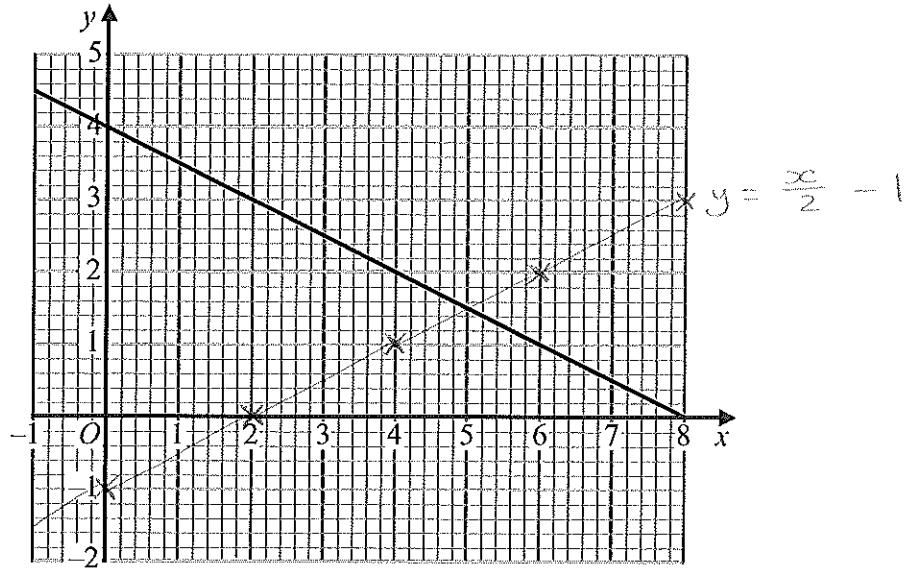
$0 \leqslant L < 10$

(1)

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

$m = +\frac{1}{2}$ (gradient)

$c = -1$ (y-intercept)

(3)

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

$x + 2y = 8$

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

Co-ordinate where graphs meet $= (5, 1.5)$

$x = \ldots 5 \ldots$ $y = \ldots 1.5 \ldots$

(1)

Q13

(Total 4 marks)

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

$6.43 \times 100,000 = 643,000$

.........643,000.........

(1)

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

$2 \times 8 = 16 = 1.6 \times 10^1$

$10^7 \times 10^{-12} = 10^{7-12} = 10^{-5}$

$1.6 \times 10^1 \times 10^{-5} = 1.6 \times 10^{-4}$

.....1.6×10^{-4}.........

(2)

(Total 3 marks)

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

$2(x^2 - 2xy)$

$2x(x - 2y)$

.....$2x(x - 2y)$.........

(2)

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

$(-4) + (-2) = -6$

$(-4) \times (-2) = +8$

$(p-4)(p-2)$

(2)

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

$\dfrac{(x+2)(x+2)}{(x+2)} = \dfrac{x+2}{1} = x+2$

.........$x+2$.........

(1)

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

$2 \times 3 = 6$

$a^2 \times a^3 = a^5$ $= 6a^5b^2$

$b \times b = b^2$
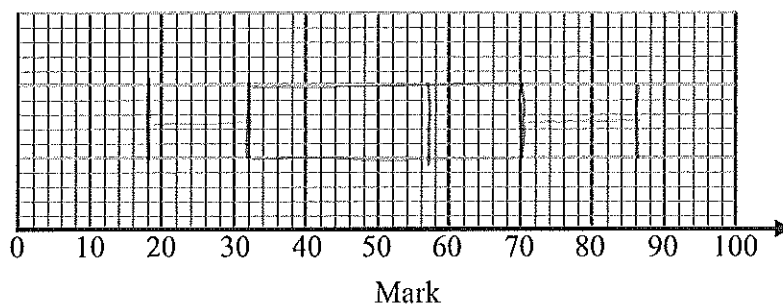
.....$6a^5b^2$.........

(2)

(Total 7 marks)

14

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

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

Mark

UQ = 32 + 38 = 70
(LQ) + (IQR)
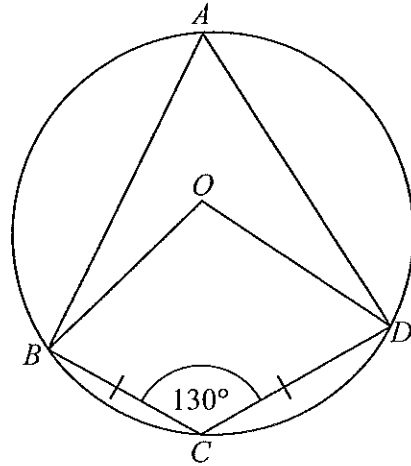
(Total 3 marks)

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.

$180 - 130 = 50$

Opposite angles in cyclic quadrilateral $= 180°$

50 $°$

(2)

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

$BOD = 2 \times BAD = 100°$

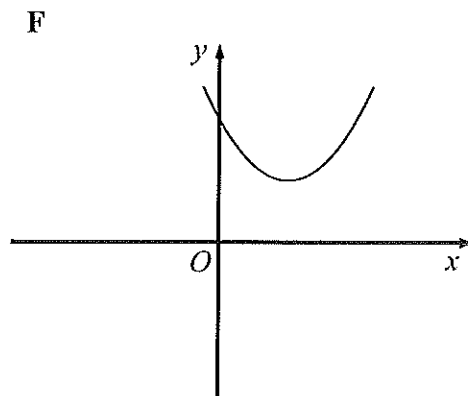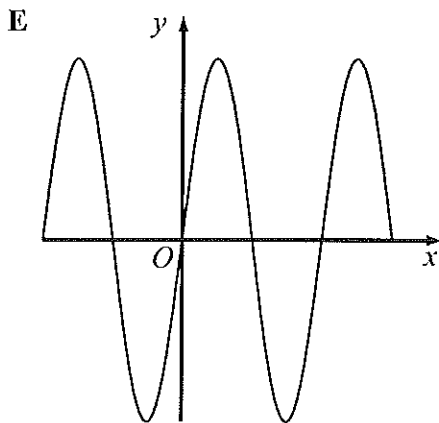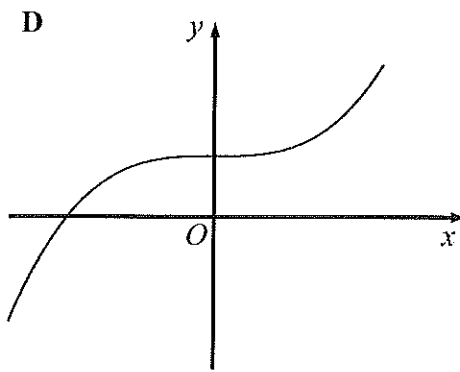$BOD + BCD = 230°$

$360 - 230 = 130$

$130 \div 2 = 65°$

65 $°$

(4)

Q19

(Total 6 marks)

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

20.
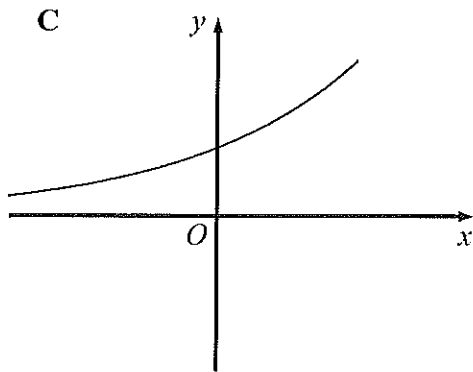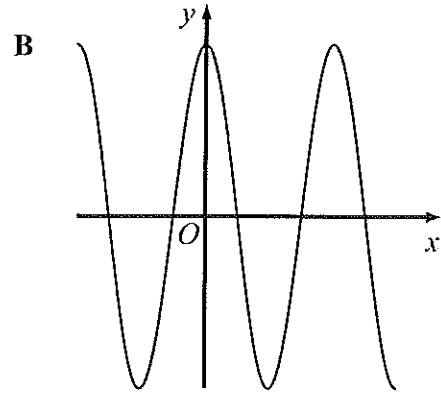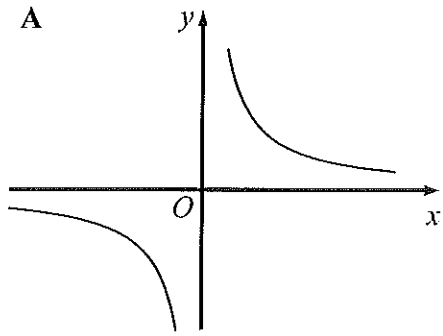

A   B

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)
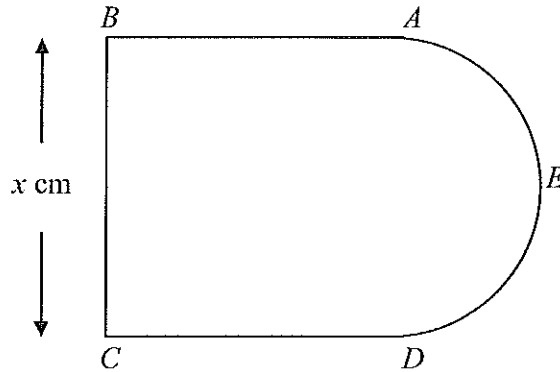
Q20

21. Here is a shape *ABCDE*.

Diagram **NOT** accurately drawn

x cm

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.

$3x + \dfrac{\pi x}{2}$ factorises to $x\left(3 + \dfrac{\pi}{2}\right)$

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

$\div\left(3 + \dfrac{\pi}{2}\right) \qquad \left(\therefore 3 + \dfrac{\pi}{2}\right)$

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

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

(2)

The area, A cm^2, 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.

$$\text{Area} = x^2 + \frac{1}{2}\pi\left(\frac{x}{2}\right)^2$$

$\uparrow$
ABCD
square

$\uparrow$
A DE
semi circle

$$kx^2 = x^2 + \frac{1}{2}\pi\frac{x^2}{4}$$

$$kx^2 = x^2 + \frac{\pi x^2}{8}$$

Factorise RHS

$$kx^2 = x^2\left(1 + \frac{\pi}{8}\right)$$

$$\therefore k = 1 + \frac{\pi}{8}$$

$k = 1 + \dfrac{\pi}{8}$

(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.

$$\left(2 + \sqrt{2}\right)\left(3 + \sqrt{8}\right)$$

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

$$= 6 + 2\sqrt{8} + 3\sqrt{2} + 4$$

$$\sqrt{8} = \sqrt{2} \times \sqrt{4} = 2\sqrt{2}$$

$$2\sqrt{8} = 2 \times \sqrt{2} \times \sqrt{4} = 4\sqrt{2}$$

$$4\sqrt{2} + 3\sqrt{2} = 7\sqrt{2}$$

$$\therefore = 10 + 7\sqrt{2}$$

$10 + 7\sqrt{2}$

Q22

(Total 4 marks)

23.

Diagram **NOT**
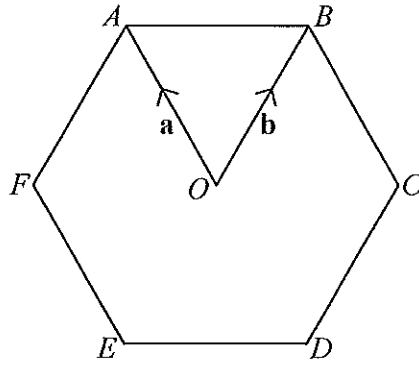accurately drawn

ABCDEF is a regular hexagon, with centre *O*.

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

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

$-a + b$

(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 **a** and **b**.
Give your answer in its simplest form.

$$AK = 3AB = 3(-a+b) = -3a + 3b$$

$$\overrightarrow{CK} = \overrightarrow{CA} + \overrightarrow{AK}$$

$$CA = 2a + 2a - b$$

$$AK = -3a + 3b$$

$$CK = 2a - b - 3a + 3b$$

$$= -a + 2b$$

$-a + 2b$

(3)

Q23

(Total 4 marks)

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

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

(a) Show that Umar is wrong.

LHS(1) $(1 + 1)^2 = 4$ $4 \neq 2$

RHS(1) $1^2 + 1 = 2$

(2)

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

Diagrams **NOT**
accurately drawn
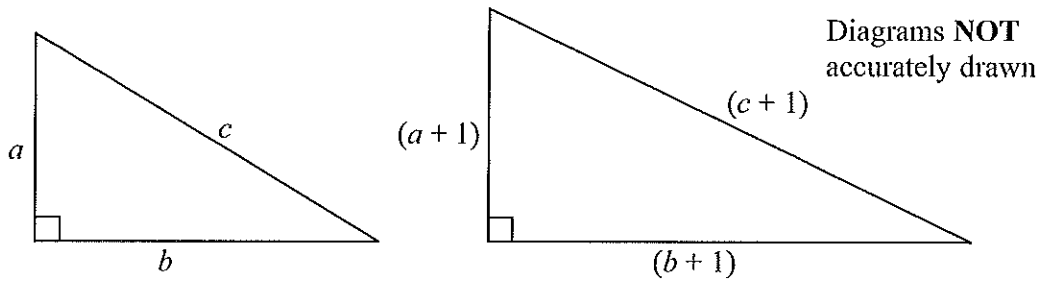
(b) Show that $2a + 2b + 1 = 2c$

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

$(a + 1)^2 + (b + 1)^2 = (c + 1)^2$

$a^2 + 2a + 1 + b^2 + 2b + 1 = c^2 + 2c + 1$

sub c^2 for $a^2 + b^2$

$\cancel{a^2} + 2a + 1 + \cancel{b^2} + 2b + 1 = \cancel{c^2} + \cancel{b^2} + 2c + 1$

$2a + 1 + 2b + 1 = 2c + 1 \therefore 2a + 2b + 1 = 2c$

(3)

a, b and c cannot all be integers.

(c) Explain why.

One side would be odd

the other would be even

(1)

Q24

(Total 6 marks)

TOTAL FOR PAPER: 100 MARKS

END

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