

GCSE Mathematics

Practice Tests: Set 6

Paper 1H (Non-calculator)

Time: 1 hour 30 minutes

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

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 out.**



Information

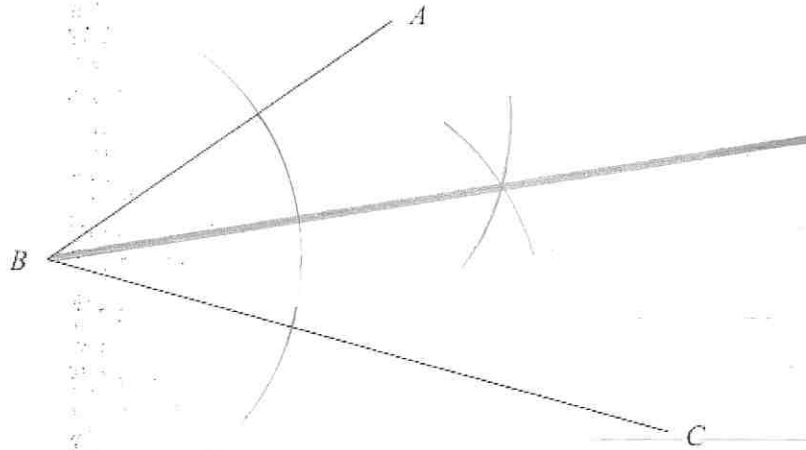
- The total mark for this paper is 80
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

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.

Answer ALL questions.
Write your answers in the spaces provided.
You must write down all the stages in your working.

1. Use ruler and compasses to construct the bisector of angle ABC .
You must show all your construction lines.



(Total 2 marks)

2. Peter, Tarish and Ben share £54.

Tarish gets three times as much money as Peter.
Ben gets twice as much money as Tarish.

How much money does Ben get?

$$\begin{array}{l|l}
 \text{Tarish} = 3x & x + 3x + 6x = 54 \\
 \text{Peter} = x & 10x = 54 \\
 \text{Ben} = 6x & x = \pounds 5.40 \\
 & 6x = \pounds 32.40
 \end{array}$$

$$\begin{array}{r}
 5.40 \times \\
 \quad 6 \\
 \hline
 32.40 \\
 \hline
 \end{array}$$

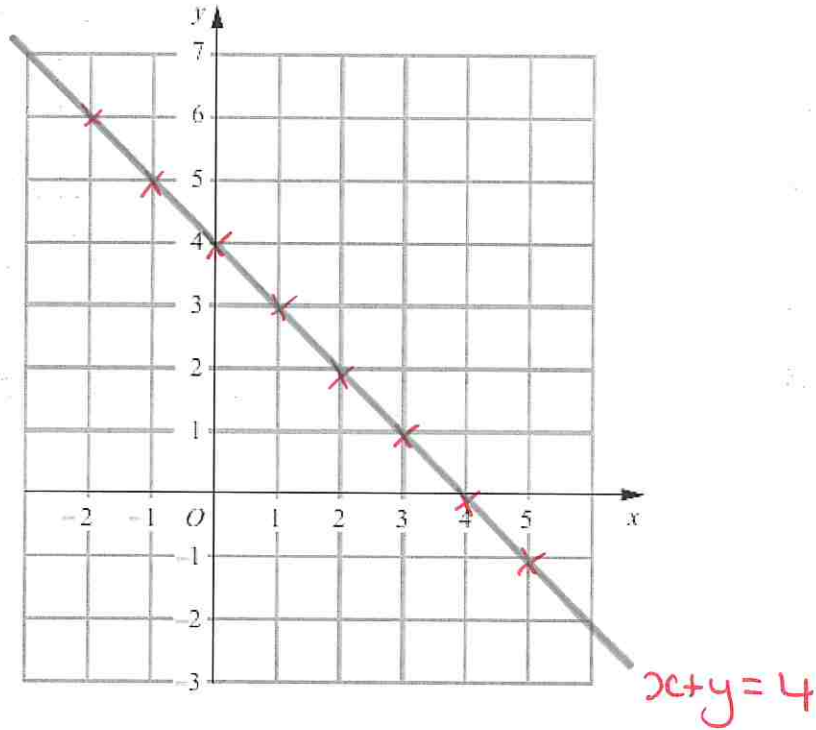
£ 32.40

(Total 3 marks)

Plotting Straight Lines

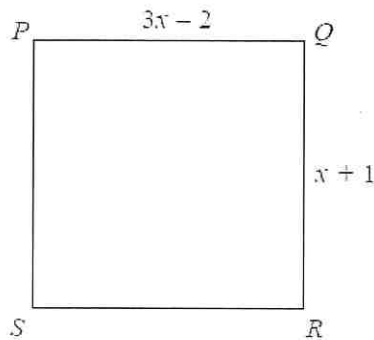
3. On the grid draw the graph of $x + y = 4$ for values of x from -2 to 5

| | | | | | | | | |
|-----|----|----|---|---|---|---|---|----|
| x | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 |
| y | 6 | 5 | 4 | 3 | 2 | 1 | 0 | -1 |



(Total 3 marks)

4. PQRS is a square.



All measurements are in centimetres.

Show that the perimeter of the square is 10 cm.

Square has equal sides

$$3x - 2 = x + 1$$

$(-x)$

$$2x - 2 = 1$$

$(+2)$

$$2x = 3$$

$(\div 2)$

$$x = \frac{3}{2}$$

Each side length

$$x + 1 = \frac{3}{2} + 1 = \frac{5}{2} = 2.5 \text{ cm}$$

Perimeter = $4 \times$ length

$$P = 4 \times 2.5 \text{ cm}$$

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



(Total 4 marks)

Compound Shapes

5. The diagram shows the plan of a floor.

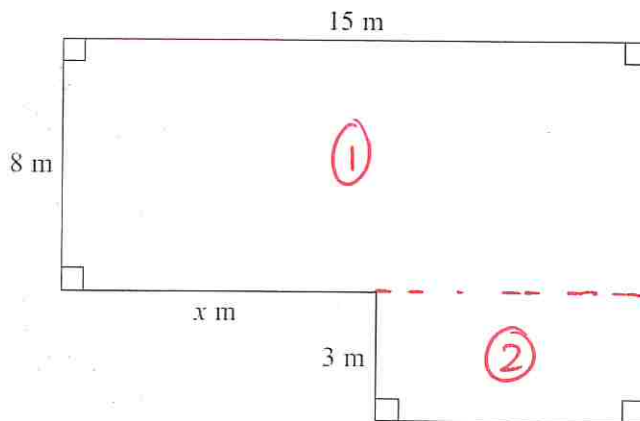


Diagram NOT accurately drawn

The area of the floor is 138 m^2 .

Work out the value of x .

$$\text{Area ①} = L \times w$$

$$A = 15\text{m} \times 8\text{m} = 120\text{m}^2$$

$$\text{Area ②} = L \times w$$

$$A = 3\text{m} \times (15 - x)$$

$$= 3(15 - x)$$

$$= 45 - 3x$$

expand

$$\text{Total Area} = \text{①} + \text{②}$$

$$\text{Total} = 120 + 45 - 3x$$

$$\text{Total} = 165 - 3x$$

$$\text{Total} = 138\text{m}^2$$

$$138 = 165 - 3x$$

$$(+3x)$$

$$3x + 138 = 165$$

$$(-138)$$

$$3x = 27$$

$$x = 9\text{m}$$

(Total 4 marks)

Converting Rates / Measures

6. There are 40 litres of water in a barrel.
 The water flows out of the barrel at a rate of 125 millilitres per second.
 1 litre = 1000 millilitres.
 Work out the time it takes for the barrel to empty completely.

1 litre = 1000 millilitres | 40 litres = 40000 millilitres

40000 millilitres \div 125 = 320

$$\begin{array}{r} 00320 \\ 125 \overline{)40000} \end{array}$$

$$\begin{array}{r} 125 \\ 250 \\ 375 \\ 500 \\ 625 \\ 750 \\ 875 \end{array}$$

USE BUS STOP
FOR DIVISION

..... 320 seconds
 (Total 3 marks)

7. (a) Work out $\frac{2}{5} + \frac{1}{4}$

(20) Common denominator | $\frac{8}{20} + \frac{5}{20}$
 $= \frac{13}{20}$

Adding Fractions

$$\frac{13}{20}$$

(2)

- (b) Work out $3\frac{1}{8} \times \frac{2}{5}$

$3\frac{1}{8} = \frac{25}{8}$ | $\frac{25}{8} \times \frac{2}{5}$
 $= \frac{18}{40}$
 Simplify | $= \frac{9}{20}$

Multiplying Mixed Numbers

MARK SCHEME IS WRONG

$$\frac{9}{20}$$

(3)
 (Total 5 marks)

Ratio and Proportion

8. Lillian, Max and Nazia share a sum of money in the ratio 2 : 3 : 5

(a) What fraction of the money does Max receive?

$$\begin{array}{l|l} \text{Total parts} & 2+3+5 = 10 \\ \text{Max} = 3\text{ parts} & \frac{3}{10} \end{array}$$

$$\frac{3}{10}$$

.....
(2)

Nazia receives £60

(b) Work out how much money Lillian receives.

$$\begin{array}{l|l} \text{Nazia} = 5\text{ parts} & 5\text{ parts} = \pounds 60 \\ \quad (\div 5) & 1\text{ part} = \pounds 12 \\ \text{Lillian} = 2\text{ parts} (\times 2) & 2\text{ parts} = \pounds 24 \end{array}$$

$$\pounds \frac{24}{\dots\dots\dots}$$

(3)

(Total 5 marks)

Solving Equations (Both sides)

9. (a) Solve $11 - 4y = 6y - 3$

$$\begin{array}{l|l} (+4y) & 11 = 10y - 3 \\ (+3) & 14 = 10y \\ (\div 10) & \frac{14}{10} = y \end{array}$$

$y = \underline{1.4}$
(2)

(b) Solve $x^2 - 3x - 40 = 0$

factorise $(x-8)(x+5) = 0$
Solve $x = 8$ or $x - 5 = 0$

sum to -3 product $= -40$

Solving Quadratics

$x = \underline{8}$, $x = \underline{-5}$
(3)

(Total 5 marks)

10. There are 11 pens in a box.

Dependent Probability Trees

6 of the pens are black.
3 of the pens are red.
2 of the pens are green.

Henry takes at random two pens from the box.

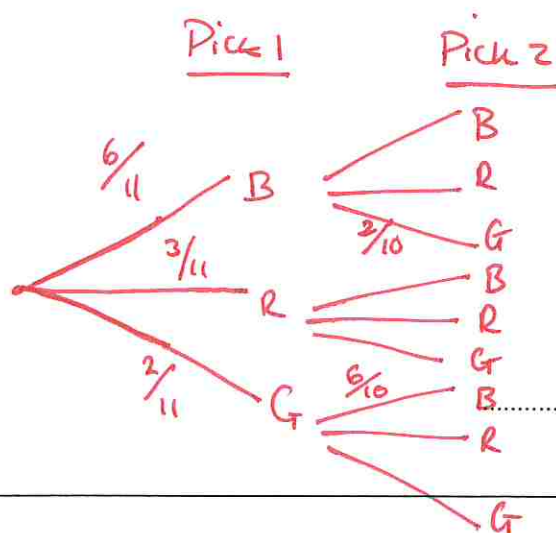
Work out the probability that he takes one black pen and one green pen.

Must choose (B,G) or (G,B)

$P(B,G) + P(G,B)$

$\frac{12}{110} + \frac{12}{110}$

$= \underline{\underline{\frac{24}{110}}}$



$P(B,G) = \frac{6}{11} \times \frac{2}{10} = \frac{12}{110}$

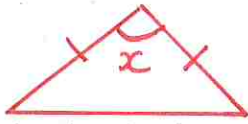
$P(G,B) = \frac{2}{11} \times \frac{6}{10} = \frac{12}{110}$

(Total 4 marks)

2D shapes (Angles in triangles)

11. The size of the obtuse angle in an isosceles triangle is x° .

Write an expression, in terms of x , for the size, in degrees, of one of the other two angles.



The other 2 angles = $180 - x$ | 180° in a Δ
 The angles are equal = $\frac{180 - x}{2}$ | Isosceles Δ .

$$\frac{180 - x}{2}$$

(Total 2 marks)

12. (a) Write down the value of $9^{\frac{1}{2}}$

$$a^{\frac{1}{n}} = \sqrt[n]{a}$$

Index Laws

$$3$$

(1)

- (b) Write down the value of $8^{\frac{1}{3}}$

$$a^{\frac{1}{n}} = \sqrt[n]{a} \quad \left| \quad 8^{\frac{1}{3}} = 2 \right.$$

$$a^{-m} = \frac{1}{a^m} \quad \left| \quad 8^{-\frac{1}{3}} = \frac{1}{2} \right.$$

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

(1)

$$2^k = 16$$

- (c) Write down the value of k .

$$\begin{aligned} 2^0 &= 1 \\ 2^1 &= 2 \\ 2^2 &= 4 \\ 2^3 &= 8 \\ 2^4 &= 16 \end{aligned}$$

$$\therefore k = 4$$

(1)

- (d) Solve $8^5 = 2^{2m+3}$

$$8 = 2^3 \quad \left| \quad (2^3)^5 = 2^{2m+3} \right.$$

Expand $(a^m)^n = a^{mn}$

$$2^{15} = 2^{2m+3}$$

Drop Bases

$$2^{15} = 2^{2m+3} \quad \therefore 15 = 2m + 3$$

$$(-3)$$

$$12 = 2m$$

$$(\div 2)$$

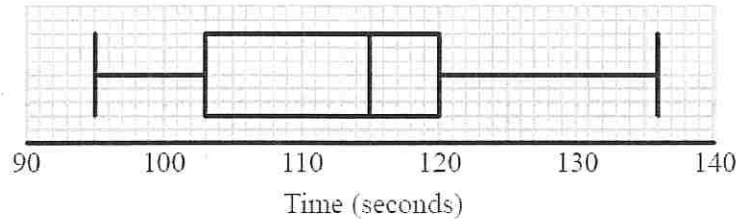
$$6 = m$$

(Total 6 marks)

Averages from Raw Data Comparing Box Plots

13. Tom recorded the times, in seconds, some boys took to complete an obstacle course.

He drew this box plot for his results.



Tom also recorded the times some girls took to complete the obstacle course.

Here are the times, in seconds, for the girls.

99 101 103 106 108 109 110 110 111 112
113 114 115 115 117 120 124 125 132

Compare the distribution of the times for the boys with the distribution of the times for the girls.

median \Rightarrow Middle term

Spread \Rightarrow IQR

medians

Boys: 115

Girls:

$\frac{19+1}{2}$ term = 10th term = 112

Quartiles: (LQ)

Boys: 103

$\frac{19+1}{4}$ term = 5th term = 108

(UQ)

Boys: 120

... = 15th term = 117

IQR = UQ - LQ

IQR = 17

IQR = 117 - 108 = 9

Compare distributions

On average, the boys took longer to complete the course (larger median). The spread of the boy's data was bigger (larger IQR) which implies their data is less reliable.

(Total for 4 marks)

Standard Form

14. (a) Write 8.2×10^5 as an ordinary number.

0000008.2
5 jumps
820000

820000

(1)

- (b) Write 0.000 376 in standard form.

3 jumps
4 jumps

3.76×10^{-4}

(1)

- (c) Work out the value of $(2.3 \times 10^{12}) \div (4.6 \times 10^3)$
Give your answer in standard form.

split | $2.3 \div 4.6 = 0.5$
 $10^{12} \div 10^3 = 10^9$
combine | $= 0.5 \times 10^9$
standard form | $= 5 \times 10^8$

5×10^8

(2)

(Total 4 marks)

Vectors

15.

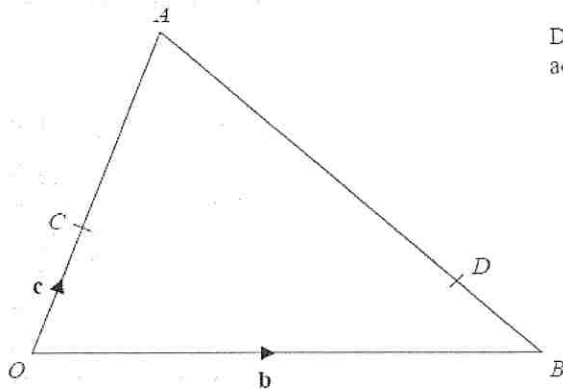


Diagram NOT accurately drawn

In the diagram,

$$\overrightarrow{OB} = \mathbf{b}$$

$$\overrightarrow{OC} = \mathbf{c}$$

$$\overrightarrow{OC} = \frac{1}{3} \overrightarrow{OA}$$

$$\overrightarrow{BD} = \frac{1}{4} \overrightarrow{BA}$$

Find CD in terms of \mathbf{b} and \mathbf{c} .

Give your answer in its simplest form.
You must show all your working.

We choose this method since we are given \overrightarrow{BD}

$$\overrightarrow{CB} = \overrightarrow{CA} + \overrightarrow{AB} \quad \text{OR}$$

$$\begin{aligned} \overrightarrow{BA} &= -\mathbf{b} + \overrightarrow{OA} \\ &= -\mathbf{b} + 3\mathbf{c} \end{aligned}$$

$$\begin{aligned} \overrightarrow{CD} &= \overrightarrow{CO} + \overrightarrow{OB} + \overrightarrow{BD} \\ &= -\mathbf{c} + \mathbf{b} + \frac{1}{4} \overrightarrow{BA} \\ &= -\mathbf{c} + \mathbf{b} + \frac{1}{4} (-\mathbf{b} + 3\mathbf{c}) \\ &= -\mathbf{c} + \mathbf{b} - \frac{1}{4} \mathbf{b} + \frac{3}{4} \mathbf{c} \\ &= \frac{3}{4} \mathbf{b} + \frac{3}{4} \mathbf{c} - \mathbf{c} \\ &= \frac{3}{4} \mathbf{b} - \frac{1}{4} \mathbf{c} \\ &= \frac{1}{4} (3\mathbf{b} - \mathbf{c}) \end{aligned}$$

$$\frac{1}{4} (3\mathbf{b} - \mathbf{c})$$

(Total 4 marks)

Independence and Mutually Exclusive Events

16. Two events, A and B , are mutually exclusive.

$$P(A) = 0.3$$

$$P(B) = 0.5$$

- (a) Work out $P(A')$

$$P(A) + P(A') = 1$$

$$\therefore P(A') = 0.7$$

0.7

(1)

- (b) Work out $P(A \cup B)$

↓
OR

$$\begin{aligned} &= P(A) + P(B) = 0.3 + 0.5 \\ &= 0.8 \end{aligned}$$

0.8

(1)

$$P(C) = 0.4$$

$$P(D) = 0.2$$

$$P(C \cap D) = 0.06$$

- (c) Are C and D independent events?
Explain your answer.

Independent if $P(C) \times P(D) = P(C \cap D)$

But $0.4 \times 0.2 \neq 0.06 \therefore$ Not independent

(2)

(Total 4 marks)

Simplifying Algebraic Fractions

17. Simplify fully $\frac{2x^2 + 9x - 5}{6x^2 - 5x + 1}$

| | |
|------------------|--|
| factorise top | $(2x - 1)(x + 5)$ |
| factorise bottom | $(3x - 1)(2x - 1)$ |
| simplify | $\frac{\cancel{(2x - 1)}(x + 5)}{(3x - 1)\cancel{(2x - 1)}}$ |
| | $\frac{x + 5}{3x - 1}$ |

$$\frac{x + 5}{3x - 1}$$

.....
(Total 3 marks)

Circle Theorems

18.

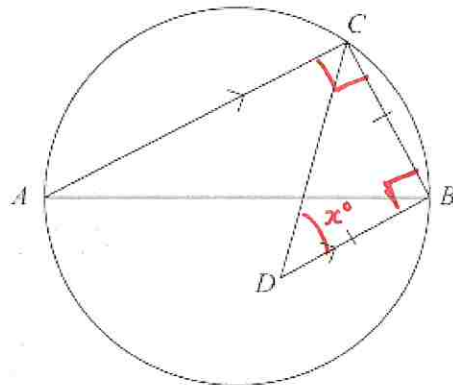


Diagram NOT accurately drawn

AB is a diameter of a circle.

C is a point on the circle.

D is the point inside the circle such that $BD = BC$ and BD is parallel to CA .

Find the size of angle CDB .

You must give reasons for your answer.

$$\hat{ACB} = 90^\circ$$

$$\hat{CBD} = \hat{ACB} = 90^\circ$$

Angles in a semi-circle = 90°

Co-interior angles in parallel lines sum to 180°



$BC = BD$ (given)

$\therefore BCD$ is an isosceles triangle.

180° in a triangle

$$(-90)$$

$$(\div 2)$$

$$\therefore x + x + 90 = 180$$

$$2x + 90 = 180$$

$$2x = 90$$

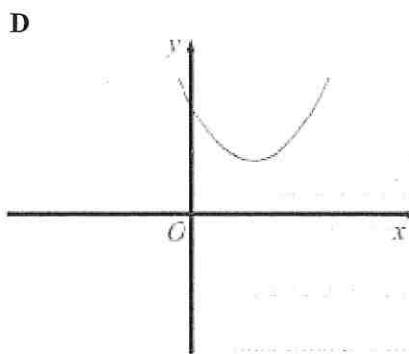
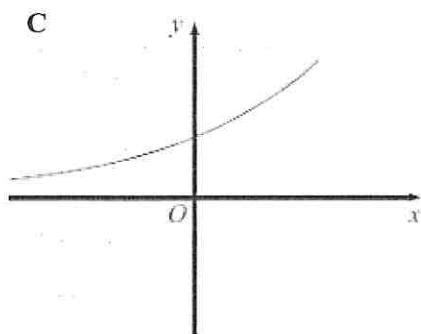
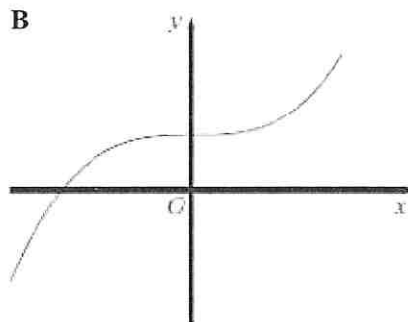
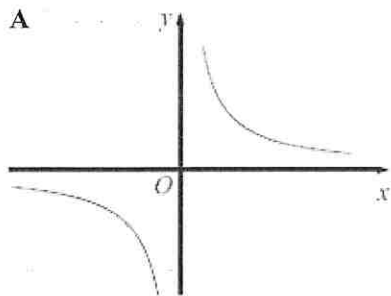
$$\hat{BDC} = x = 45^\circ$$

45

(Total 4 marks)

Recognising Sketches

19.



Each equation in the table represents one of the graphs **A** to **D**.
Write the letter of each graph in the correct place in the table.

| | Equation | Graph |
|-------------|--------------------|-------|
| Quadratic | $y = x^2 - 4x + 5$ | D |
| Exponential | $y = 4^{2x}$ | C |
| Cubic | $y = x^3 + 4$ | B |
| Reciprocal | $y = \frac{4}{x}$ | A |

(Total 3 marks)

Expanding Brackets (Surd)

20. Expand $(1 + \sqrt{2})(3 - \sqrt{2})$

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

$$\sqrt{2} \times -\sqrt{2} = -2$$

collect

$$\begin{aligned}(1 + \sqrt{2})(3 - \sqrt{2}) &= 3 - \sqrt{2} + 3\sqrt{2} - 2 \\ &= \underline{\underline{1 + 2\sqrt{2}}}\end{aligned}$$

$$\underline{\underline{1 + 2\sqrt{2}}}$$

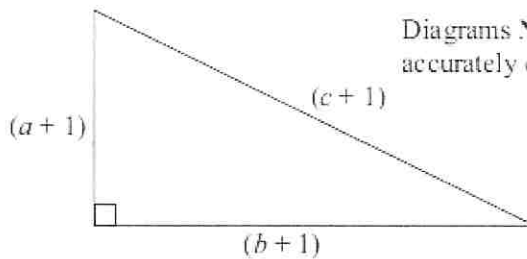
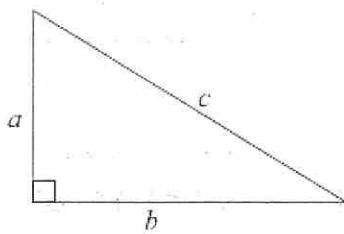
(Total 2 marks)

Expanding Brackets

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

(a) Show that Umar is wrong.

expand $(a+1)^2 = (a+1)(a+1)$
 $= a^2 + a + a + 1$
 collect $= a^2 + 2a + 1 \neq a^2 + 1$ \square .
 Here are two right-angled triangles.
 All the measurements are in centimetres.



Diagrams NOT accurately drawn

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

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

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

Substitute (1) in (2)
 $(-a^2) (-b^2)$ $\therefore a^2 + b^2 + 2a + 2b + 1 = a^2 + b^2 + 2c$
 $2a + 2b + 1 = 2c$ \square (3)

a , b and c cannot all be integers.

(c) Explain why.

~~Because there is no Pythagorean triple set that, given~~

Assume a , b and c ARE integers. Then $2a + 2b = \text{even}$, $2a = \text{even}$.

But $2a + 2b + 1 = \text{odd}$. (1)

\therefore We have assumed an odd number = an even one. (Total 6 marks)

This is a contradiction

$\therefore a, b$ and c ARE NOT integers.

TOTAL FOR PAPER IS 80 MARKS