

GCSE Mathematics

Practice Tests: Set 5

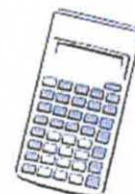
Paper 3H (Calculator)

Time: 1 hour 30 minutes

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

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

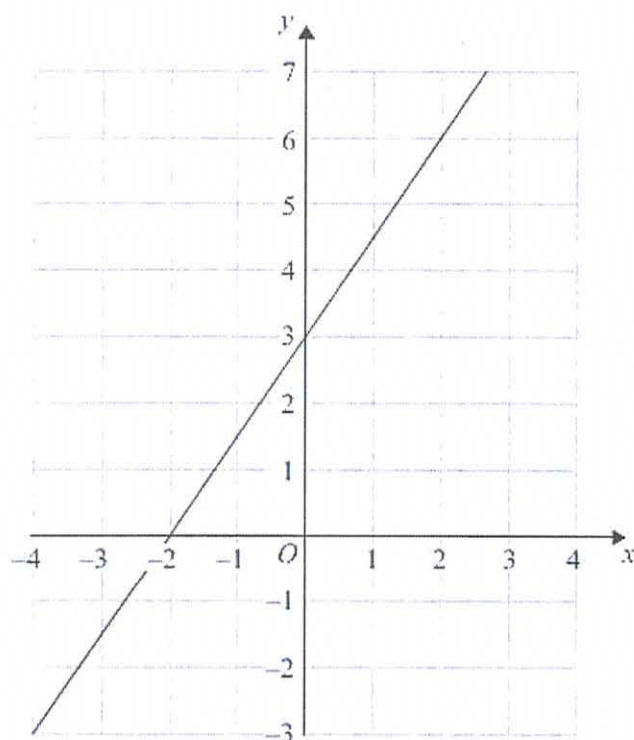
- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1.



Find the gradient of the straight line drawn on this grid.

$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad \left| \quad m = \frac{6 - 3}{2 - 0} \right.$$

$$(0, 3) \text{ and } (2, 6) \quad \left. = \frac{3}{2} \right.$$

$$\frac{3}{2}$$

(Total 2 marks)

Frequency Polygon

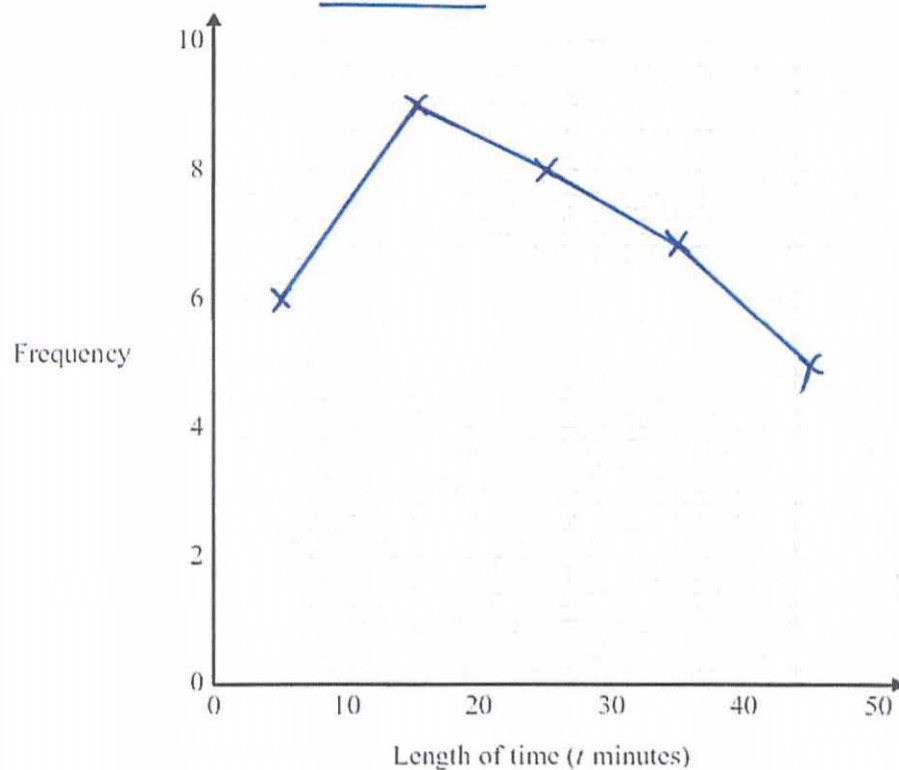
2. Helen went on 35 flights in a hot air balloon last year.

The table gives some information about the length of time, t minutes, of each flight.

| Length of time (t minutes) | Frequency |
|-------------------------------|-----------|
| $0 < t \leq 10$ | 5 |
| $10 < t \leq 20$ | 15 |
| $20 < t \leq 30$ | 25 |
| $30 < t \leq 40$ | 35 |
| $40 < t \leq 50$ | 45 |

On the grid below, draw a frequency polygon for this information.

midpoints



(Total 2 marks)

6. Henry is thinking about having a water meter.

These are the two ways he can pay for the water he uses.

| Water Meter | No Water Meter |
|--|---------------------------|
| A charge of £28.20 per year | A charge of £107 per year |
| plus | |
| 91.22p for every cubic metre of water used | |
| 1 cubic metre = 1000 litres | |

Henry uses an average of 180 litres of water each day.

Henry wants to pay as little as possible for the water he uses.
Should Henry have a water meter?

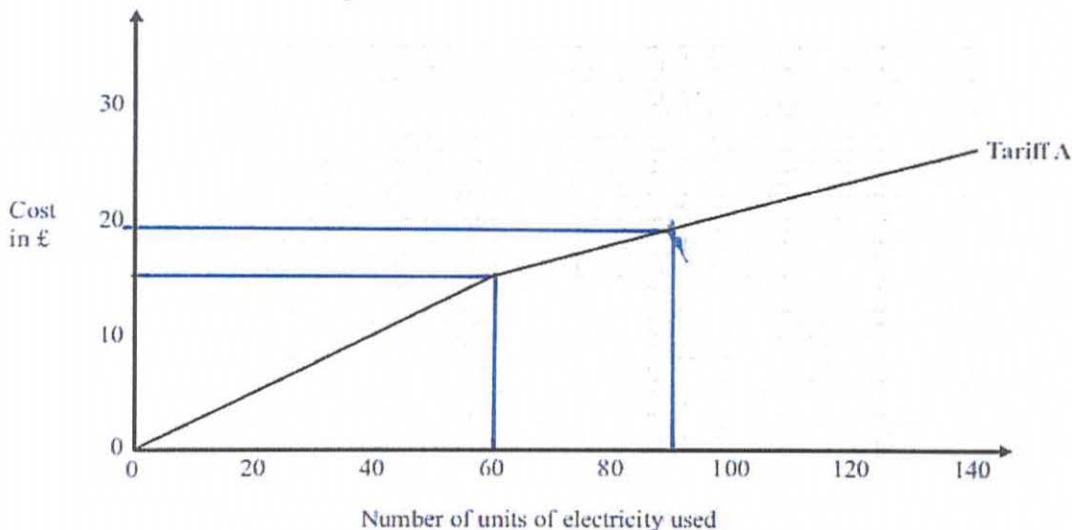
| | |
|-----------------------|---|
| Water per year | $365 \times 180 \text{ L} = 65700 \text{ Litres}$ |
| Cubic metres per year | $65700 \div 1000 = 65.7 \text{ m}^3$ |
| cost of water (pence) | $65.7 \times 91.22\text{p} = 5993.154\text{p}$ |
| cost of water (£) | $= £59.93$ |
| Total cost | $£28.20 + £59.93 = £88.13$ |
| Conclusion | Get a water meter since $£88.13 < £107$. |

(Total 5 marks)

4. Kalinda pays on Tariff A for the number of units of electricity she uses. Kalinda can use this graph to find out how much she pays each month.

(a) How much does Kalinda pay for each unit of electricity she uses up to a total of 60 units?

use the graph $\left| \begin{array}{l} 60 \text{ units} = \pounds 15 \\ (\div 60) \quad 1 \text{ unit} = \pounds 0.25 = 25\text{p} \end{array} \right.$ 25 p
(2)



Kalinda could change to Tariff B.
Here is the monthly charge for Tariff B.

20p per unit of electricity used

On average, Kalinda uses 90 units of electricity each month.
Kalinda wants to pay the least amount of money for the units of electricity she uses.

- *(b) Should Kalinda change to Tariff B?
You must show all your working.

| | |
|--|---|
| <p><u>Tariff A</u></p> <p>using the graph:</p> <p>90 units = $\pounds 19$</p> | <p><u>Tariff B</u></p> <p>1 unit = 20p</p> <p>(100) 90 units = 1800p = $\pounds 18$</p> |
|--|---|

Yes, since $\pounds 18 < \pounds 19$.

(3)

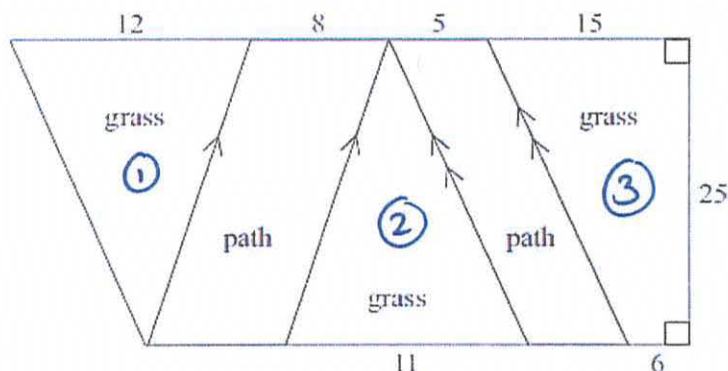
(Total 5 marks)

Area of 2D Shapes

5. David is planning his garden.

There will be two paths in the garden.
The rest of the garden will be grass.

The diagram shows David's plan for his garden.



All measurements on the diagram are given in feet.
Work out the total area of the grass.

| | | | |
|-------------------|-------------------------------------|---|--|
| ① | Grass area = $\frac{b \times h}{2}$ | $A = \frac{12 \times 25}{2} = 150 \text{ ft}^2$ | + |
| ② | | $A = \frac{11 \times 25}{2} = 137.5 \text{ ft}^2$ | + |
| ③ | $= \frac{h(a+b)}{2}$ | $A = \frac{25(15+6)}{2} = 262.5 \text{ ft}^2$ | |
| Total Grass area: | | A | $= \underline{\underline{550 \text{ ft}^2}}$ |

(Total 4 marks)

Simplify Algebraic Expressions

Index Laws

6. (a) Simplify $p^5 \times p^4$

$$a^m \times a^n = a^{m+n} \quad \left| \quad p^5 \times p^4 = \underline{p^9} \dots\dots\dots p^9 \right. \quad (1)$$

- (b) Simplify $q^5 \div q^2$

$$a^m \div a^n = a^{m-n} \quad \left| \quad q^5 \div q^2 = \underline{q^3} \dots\dots\dots q^3 \right. \quad (1)$$

- (c) Simplify $12tu^6 \div 6tu^5$

$$a^m \div a^n = a^{m-n} \quad \left| \quad \frac{12tu^6}{6tu^5} = \underline{2u} \dots\dots\dots 2u \right. \quad (2)$$

- (d) Simplify $(9w^2y^6)^{\frac{1}{2}}$

$$(a^m)^n = a^{m \times n} \quad \left| \quad \begin{array}{l} = 9^{\frac{1}{2}} w y^3 \\ 9^{\frac{1}{2}} = 3 \end{array} \right. \quad \begin{array}{l} \dots\dots\dots 3wy^3 \\ (2) \end{array}$$

- (e) For $x > 1$, write the following expressions in order of size.
Start with the expression with the least value.

$$x^0 \qquad x^2 \qquad x \qquad x^{-2} \qquad x^{\frac{1}{2}}$$

$$\underline{x^{-2}, x^{-1}, x^{\frac{1}{2}}, x, x^2} \quad (2)$$

(Total 8 marks)

Percentages of an Amount

7. Here are three cubes.

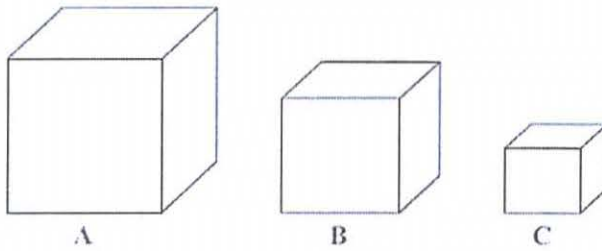


Diagram NOT
accurately drawn

The volume of cube **B** is 20% less than the volume of cube **A**.
The volume of cube **C** is 20% less than the volume of cube **B**.

Cube **A** has a volume of 8000 cm^3 .

What is the volume of cube **C** as a percentage of the volume of cube **A**?

$$\text{cube A} = 8000 \text{ cm}^3$$

$$20\% = 1600 \text{ cm}^3$$

$$\text{cube B} = 6400 \text{ cm}^3$$

$$20\% = 1280 \text{ cm}^3$$

Proportion of $\frac{\text{cube C}}{\text{cube A}}$

as a percentage
($\times 100$)

$$\text{cube B} = \text{cube A} - 20\%$$

$$\text{cube B} = 6400 \text{ cm}^3$$

$$\text{cube C} = \text{cube B} - 20\%$$

$$\text{cube C} = 5120 \text{ cm}^3$$

$$\frac{5120}{8000} = 0.64$$

$$= \underline{\underline{64\%}}$$

(Total 4 marks)

Reverse Percentages

8. In a sale, normal prices are reduced by 15%.

Janice buys a computer in the sale.
She pays £578.

Work out what the normal price of the computer was.

| | | |
|----------------|-----------------------|-----------|
| | $100\% - 15\% = 85\%$ | |
| | $£578$ | $= 85\%$ |
| $(\div 85)$ | $£680$ | $= 1\%$ |
| $(\times 100)$ | $£680$ | $= 100\%$ |

£.....680.....

(Total 3 marks)

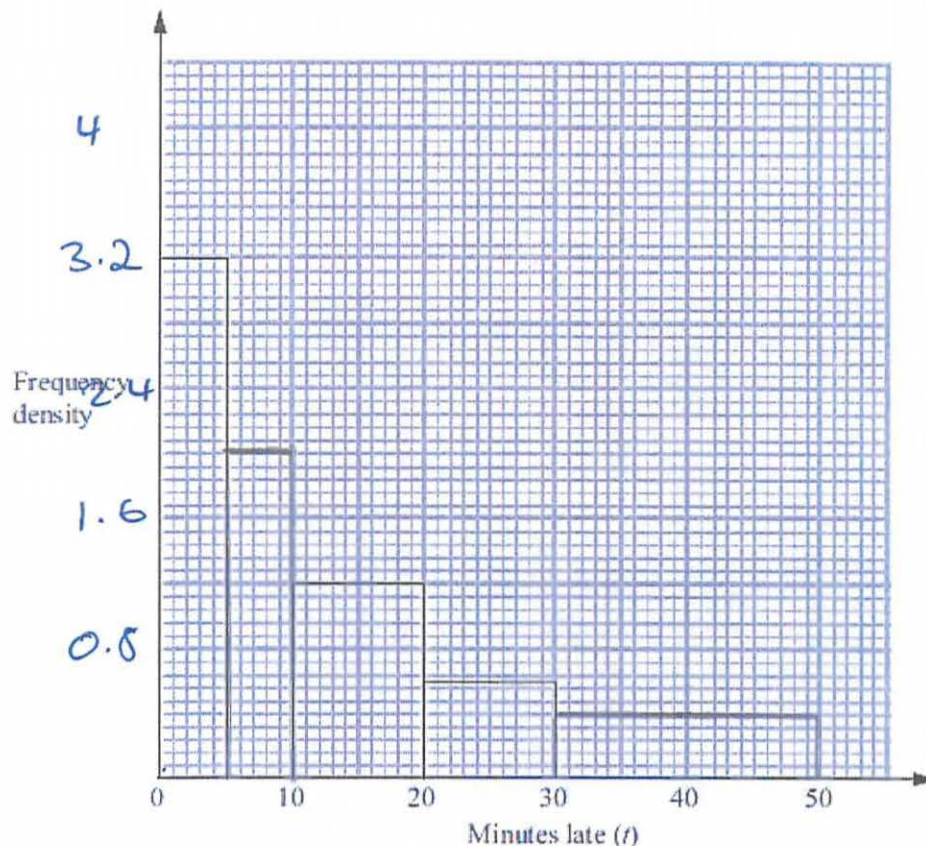
Histograms

9. Some trains from Manchester to London were late.
The incomplete table and histogram gives some information about how late the trains were.

$$\frac{f}{c.w} = f.d$$

| Minutes late (t) | | Frequency |
|----------------------|----|----------------------|
| $0 < t \leq 5$ | 5 | 16 |
| $5 < t \leq 10$ | 5 | 10 |
| $10 < t \leq 20$ | 10 | $10 \times 1.2 = 12$ |
| $20 < t \leq 30$ | 10 | $10 \times 0.6 = 6$ |
| $30 < t \leq 50$ | 20 | 8 |

$f.d$
 $3.2 \leftarrow$ use to fill in $f.d$ scale
 2
 $1.2 \leftarrow$ from graph
 $0.6 \leftarrow$ from graph
 0.4



- (a) Use the information in the histogram to complete the table. (2)
- (b) Use the information in the table to complete the histogram. (2)
- (Total 4 marks)

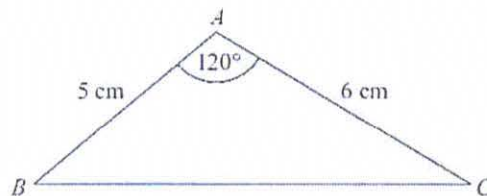
Rearranging Complex Formula

10. Make x the subject of $y = \sqrt{\frac{2x+1}{x-1}}$.

| | | |
|---|---|--|
| <p>(ANS)²</p> <p>$x(x-1)$</p> <p>expand</p> <p>$(+y^2)$</p> <p>$(-2x)$</p> <p>factorise</p> <p>$(\div(y^2-2))$</p> | $y^2 = \frac{2x+1}{x-1}$ $y^2(x-1) = 2x+1$ $xy^2 - y^2 = 2x+1$ $xy^2 = 2x+1+y^2$ $xy^2 - 2x = 1+y^2$ $x(y^2-2) = 1+y^2$ $x = \frac{1+y^2}{y^2-2}$ | $x = \frac{1+y^2}{y^2-2}$ <p>(Total 4 marks)</p> |
|---|---|--|

11.

cosine Rule



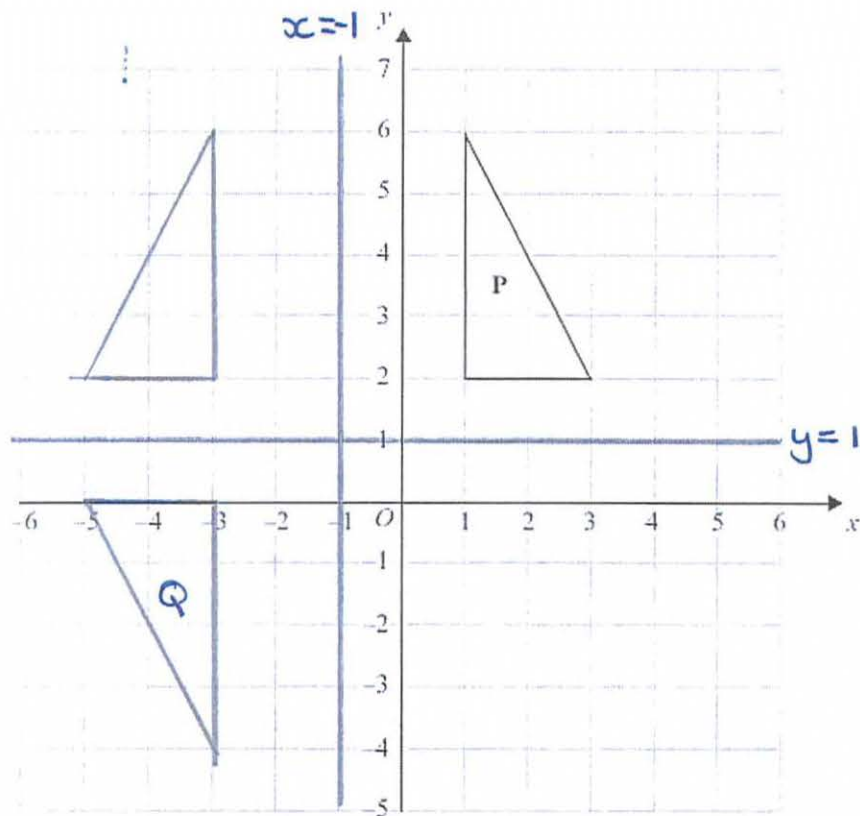
Calculate the length of the side BC .
Give your answer correct to 3 significant figures.

| | |
|---|--|
| <p>cosine Rule</p> <p>$a^2 = b^2 + c^2 - 2bc \cos A$</p> <p>$\sqrt{\text{ANS}}$</p> | $BC^2 = 5^2 + 6^2 - 2(5)(6) \cos(120)$ $BC^2 = 91$ $BC = 9.54 \text{ (3s.f.)}$ |
|---|--|

9.54 cm

(Total 3 marks)

12.



Triangle P is drawn on a coordinate grid.

The triangle P is reflected in the line $x = -1$ and then reflected in the line $y = 1$ to give triangle Q.

Describe fully the single transformation which maps triangle P onto triangle Q.

Rotation of 180° centre $(-1, 1)$

(Total 3 marks)

Forming and Solving (2D Shape Properties)

13. A machine part is made by cutting a small square from the centre of a large square piece of steel.

The dimensions of the machine part are shown on the diagram.
All measurements are in cm.

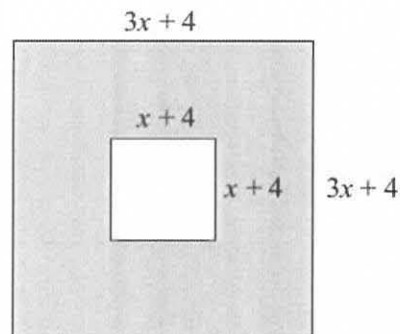


Diagram NOT
accurately drawn

The perimeter of the small square is two thirds of the perimeter of the large square.

Work out the length of a side of the small square.

Perimeter (small)

collect

$$P = x+4 + x+4 + x+4 + x+4$$

$$P = 4x+16$$

Perimeter (big)

collect

$$P = 3x+4 + 3x+4 + 3x+4 + 3x+4$$

$$P = 12x+16$$

$$\text{small} = \frac{2}{3} \text{ big}$$

expand

$$4x+16 = \frac{2}{3}(12x+16)$$

$$4x+16 = 8x + \frac{32}{3}$$

$$(-4x)$$

$$16 = 4x + \frac{32}{3}$$

$$\left(-\frac{32}{3}\right)$$

$$\frac{16}{3} = 4x$$

$$(\div 4)$$

$$\frac{4}{3} = \dots\dots\dots \text{cm}$$

(Total 5 marks)

small square side

$$L = x+4 = \frac{4}{3}+4$$

$$= \frac{16}{3}$$

Inverse Proportion

14. F is inversely proportional to the square of x .
 $F = 0.8$ when $x = 5$.

(a) Find a formula for F in terms of x .

| | | |
|--------------------|--|-------------------------------------|
| Inverse Proportion | $F \propto \frac{1}{x^2}$ $F = \frac{k}{x^2}$ $0.8 = \frac{k}{25}$ $20 = k$ | \rightarrow $F = \frac{20}{x}$ |
|--------------------|--|-------------------------------------|

$F = 0.8, x = 5$
 (x25)

$F = \frac{20}{x}$
 (3)

(b) Work out the positive value of x when $F = 320$.

| | | |
|----------|---|-------------------|
| from (a) | $F = \frac{20}{x^2}$ $320 = \frac{20}{x^2}$ $320x^2 = 20$ $x^2 = \frac{20}{320}$ | $x = 0.25$ (2) |
|----------|---|-------------------|

$F = 320$
 (x x^2)
 ($\div 320$)

(Total 5 marks)

| | |
|---|--|
| $\sqrt{\text{ANS}}$ x is positive, given. | $x = \pm \sqrt{\frac{20}{320}}$ $\therefore x = \underline{\underline{0.25}}$ |
|---|--|

Area of triangle sine

15. Here is a parallelogram.

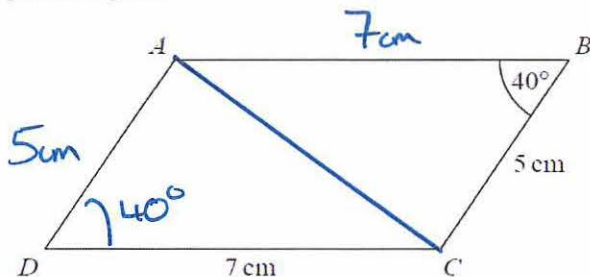
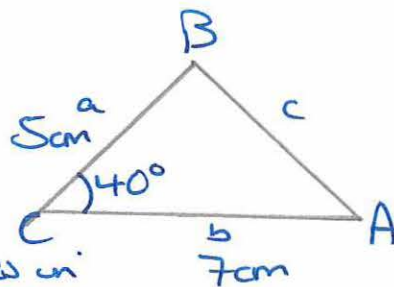


Diagram **NOT**
accurately drawn

$DC = 7 \text{ cm}$
 $CB = 5 \text{ cm}$
Angle ABC is 40°

Work out the area of the parallelogram.
Give your answer correct to 1 decimal place.



$$\hat{A} = 40^\circ$$

$$\text{Area} = \frac{1}{2}ab\sin c$$

Two Triangles

Diagonally opposite angles in
a parallelogram are equal \therefore Two triangles

$$A = \frac{1}{2}(5)(7)\sin(40)$$

$$A = 11.24878317$$

$$2A = 22.49756634$$

$$2A = 22.5 \text{ (1 d.p.)}$$

$$\dots\dots\dots 22.5 \text{ cm}^2$$

(Total 3 marks)

16. Clive wants to estimate the number of bees in a beehive.

Clive catches 50 bees from the beehive.
He marks each bee with a dye.
He then lets the bees go.

The next day, Clive catches 40 bees from the beehive.
8 of these bees have been marked with the dye.

- (i) Work out an estimate for the number of bees in the beehive.

| | |
|---|---|
| <p>"OUT OF"</p> <p>Cross multiply</p> <p>($\div 8$)</p> | $\frac{50}{x} = \frac{8}{40}$ $2000 = 8x$ $\underline{\underline{250 = x}}$ |
|---|---|

..... 250 bees

- (ii) Write down any assumptions you have made.

That the population of bees in the
beehive did not change from day to day.

.....

.....

(Total 4 marks)

17. A new shopping centre is opened and 500 new jobs are created.
After 2 years, the number of jobs has increased to 700.

Assuming that the number of jobs in the shopping centre increases exponentially, work out how many jobs there will be 5 years after the shopping centre first opened.

$$\begin{aligned} \text{Start} \times \text{multiplier}^t &= \text{End} \\ \text{multiplier} &= 1 + x\% \\ &(\div 500) \\ &\sqrt{\text{ANS}} \end{aligned}$$

Now work out for 5 years

$$500 \times \text{multiplier}^2 = 700$$

$$\text{multiplier}^2 = \frac{7}{5}$$

$$\text{multiplier} = \sqrt{\frac{7}{5}}$$

$$500 \times \left(\sqrt{\frac{7}{5}}\right)^5 = 1159.551637$$

$$\approx \underline{\underline{1159 \text{ jobs}}}$$

1159

(Total for 5 marks)

Subtracting Algebraic Fractions

18. Write as a single fraction in its simplest form $\frac{2}{x-4} - \frac{1}{x+3}$

| | |
|----------------|--------------------------------------|
| cross multiply | $\frac{2(x+3) - 1(x-4)}{(x-4)(x+3)}$ |
| expand | $\frac{2x+6 - x+4}{(x-4)(x+3)}$ |
| collect | $\frac{x+10}{(x+3)(x-4)}$ |

$$\frac{x+10}{(x+3)(x-4)}$$

(Total 3 marks)

Dependent Probability Trees

19. Nomusa has 30 sweets.

She has
18 fruit sweets
7 aniseed sweets
5 mint sweets

Nomusa is going to take at random two sweets.

Work out the probability that the two sweets will **not** be the same type of sweet.
You must show all your working.

AND means \times

OR means $+$

Pick 1

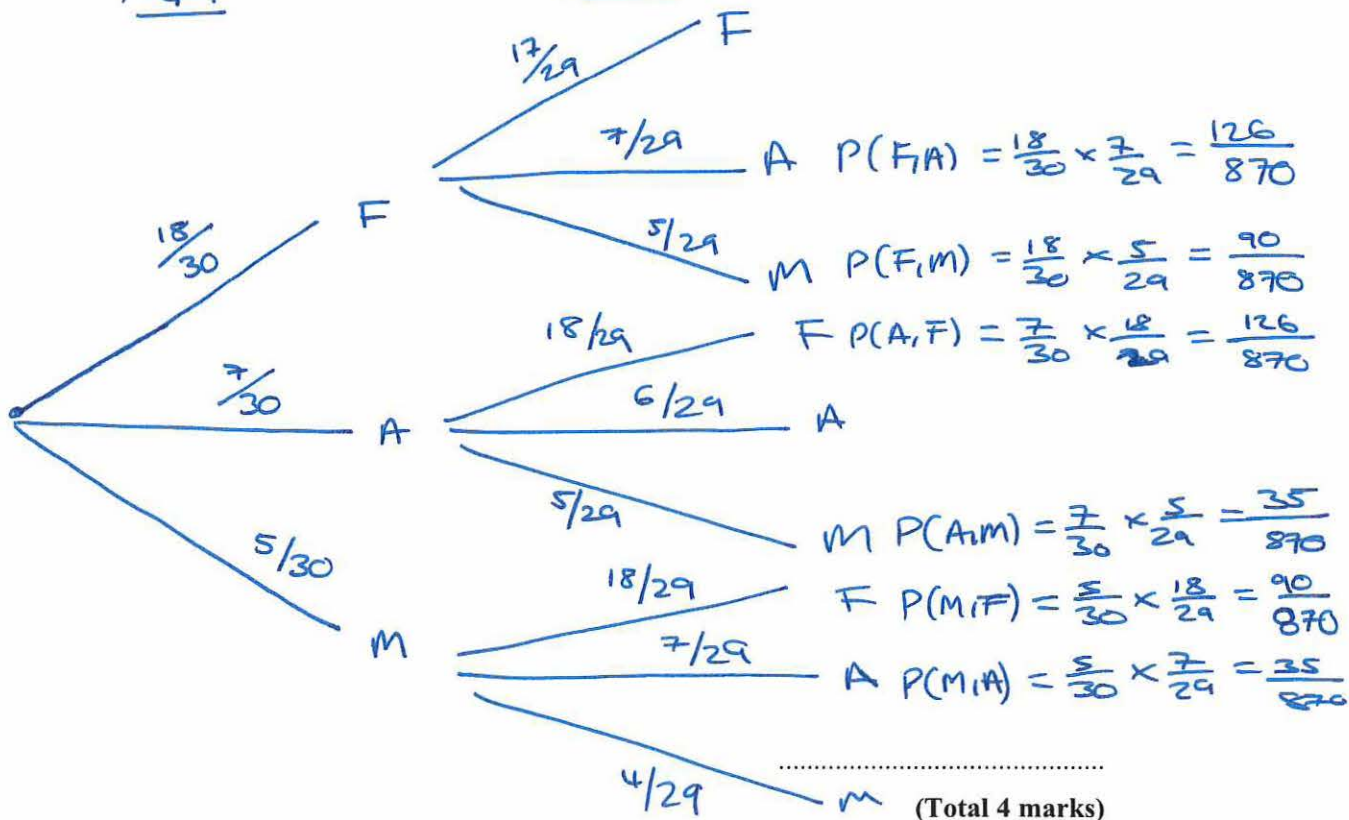
$P(\text{NOT same type})$

$$= P(F,A) + P(F,M) + P(A,F) + P(A,M) + P(M,F) + P(M,A)$$

$$= \frac{126 + 90 + 126 + 35 + 90 + 35}{870}$$

$$= \frac{502}{870}$$

Pick 2



$$\frac{502}{870}$$

20. Solve the inequality $x(2x + 3) > 20$

Expand
(-20)
factorise
Solve
LOGIC:
Conclusion

$$2x^2 + 3x > 20$$

$$2x^2 + 3x - 20 > 0$$

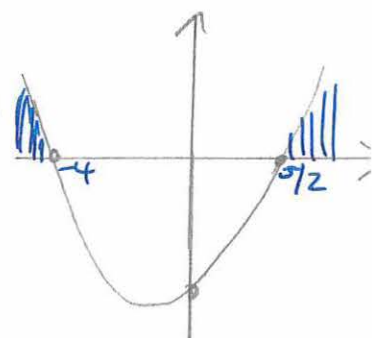
$$(2x - 5)(x + 4)$$

$$x = \frac{5}{2}, x = -4$$

where is the function > 0 ?

$$\therefore \underline{\underline{x < -4 \text{ and } x > \frac{5}{2}}}$$

Sketch:



(Total 4 marks)

TOTAL FOR PAPER IS 80 MARKS