

GCSE Mathematics  
 Non Calculator  
 Higher Tier  
 Free Practice Set 4  
 1 hour 45 minutes



**ANSWERS**

Marks shown in brackets for each question (2)

A*	A	B	C	D	E
88	75	60	45	25	15

**Legend used in answers**

**Green** Box - Working out

5b means five times b  
 $b = -3$  so  $5 \times -3 = -15$

**Red** Box and ✓ - Answer

48 % ✓

**Authors Note**

Every possible effort has been made to ensure that everything in this paper is accurate and the author cannot accept responsibility for any errors.

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1. Work out

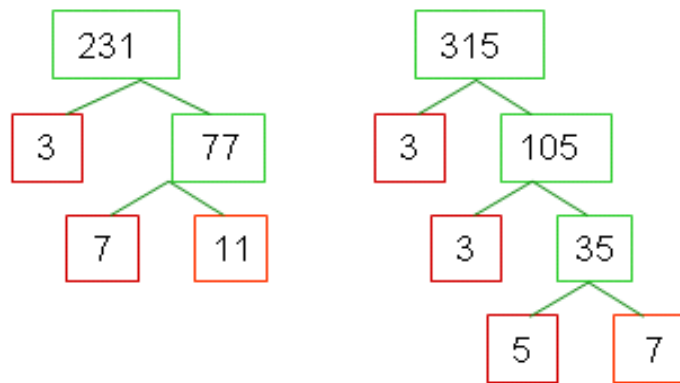
$$7.69 \times 53$$

	50	3	
700	35000	2100	37100
60	3000	180	3180
9	450	27	477
			40757

407.57 ✓

(2)

2. a) Draw a prime factor tree for 231 and 315



(2)

b) Using your prime factor tree or otherwise work out the Highest Common Factor for 231 and 315

**3 and 7 are in both factor trees so  $3 \times 7 = 21$  is the HCF**

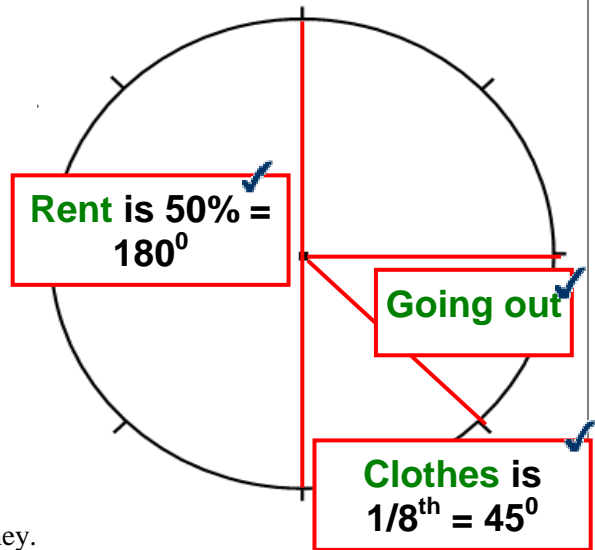
21 ✓

(1)

3. In 2005, a woman earned £240 each week.

The table shows how she spent her money.

Rent	£120
Food	£60
Clothes	£30
Going out	£30



- a) Complete the pie chart opposite to show how the woman spent her money.

(2)

Remember to **label** each sector of the pie chart.

4. a) Cyril starts with 3 white and 2 black counters in a bag

He adds some more white counters in the bag.  
He takes out one counter without looking.

The **probability** that the counter will be **black** is  $\frac{1}{4}$

**How many more** white counters did Cyril add to the bag?

	White	Black	probability of black
start	3	2	2 out of 3
Add 1	4	2	2 out of 6 or 1 out of 3
Add 2	5	2	2 out of 7
Add 3	6	2	2 out of 8 or 1 out of 4

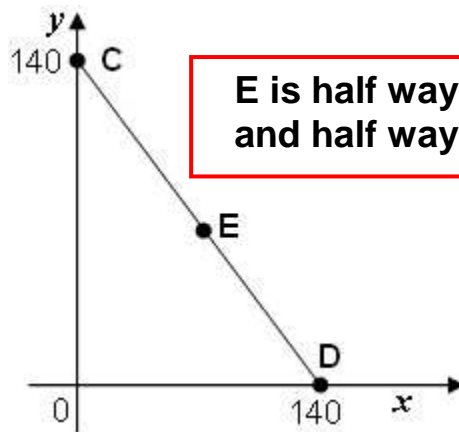
$\frac{1}{4}$  is the same as  $\frac{2}{8}$

We have the right number of black counters and 5 counters in total. so we need to add 3 more whites

3

(2)

5.

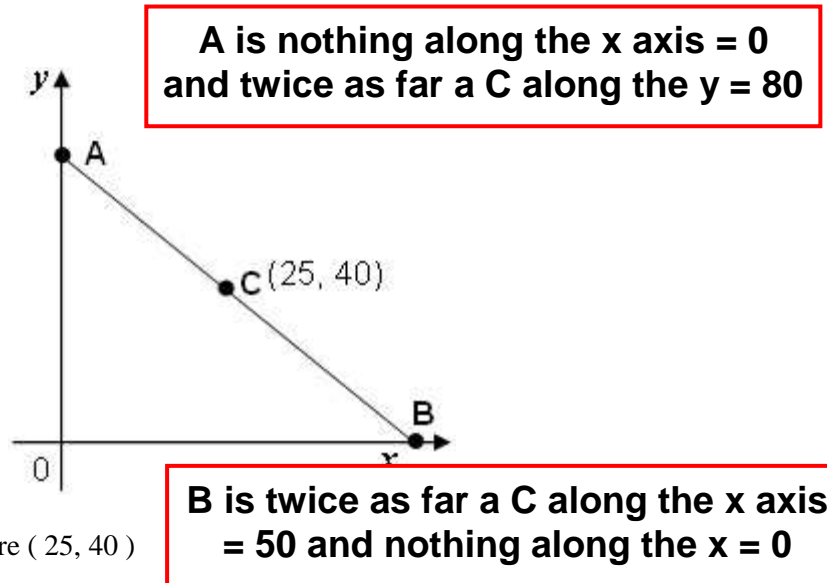


(a) E is the midpoint of line CD.

What are the coordinates of point E?

E is (  ,  ) (1)

(b) C is the midpoint of line AB.



The coordinates of C are ( 25, 40 )

What are the coordinates of points A and B?

A is (  ,  ) (1)

B is (  ,  ) (1)

6. Outside a school, the speed of passing cars was recorded.

The speeds of 17 cars are shown below.

14    17    20    25    31    40    17    21    27  
32    33    18    24    28    24    29    24

a) Draw an ordered stem and leaf diagram to show this information  
Remember to include a key.

1	4, 7, 7, 8
2	0, 1, 4, 4, 4, 5, 7, 8, 9
3	1, 2, 3,
4	0,

key 1 | 8 = 18 (3)

b) What is the median speed?

Median is middle one – the 9<sup>th</sup>  
one from either end

..... 24 (1)

7.

On the grid, draw the graphs of

$$x = -2$$

$$y = -1 \quad \text{and} \quad y = 3$$

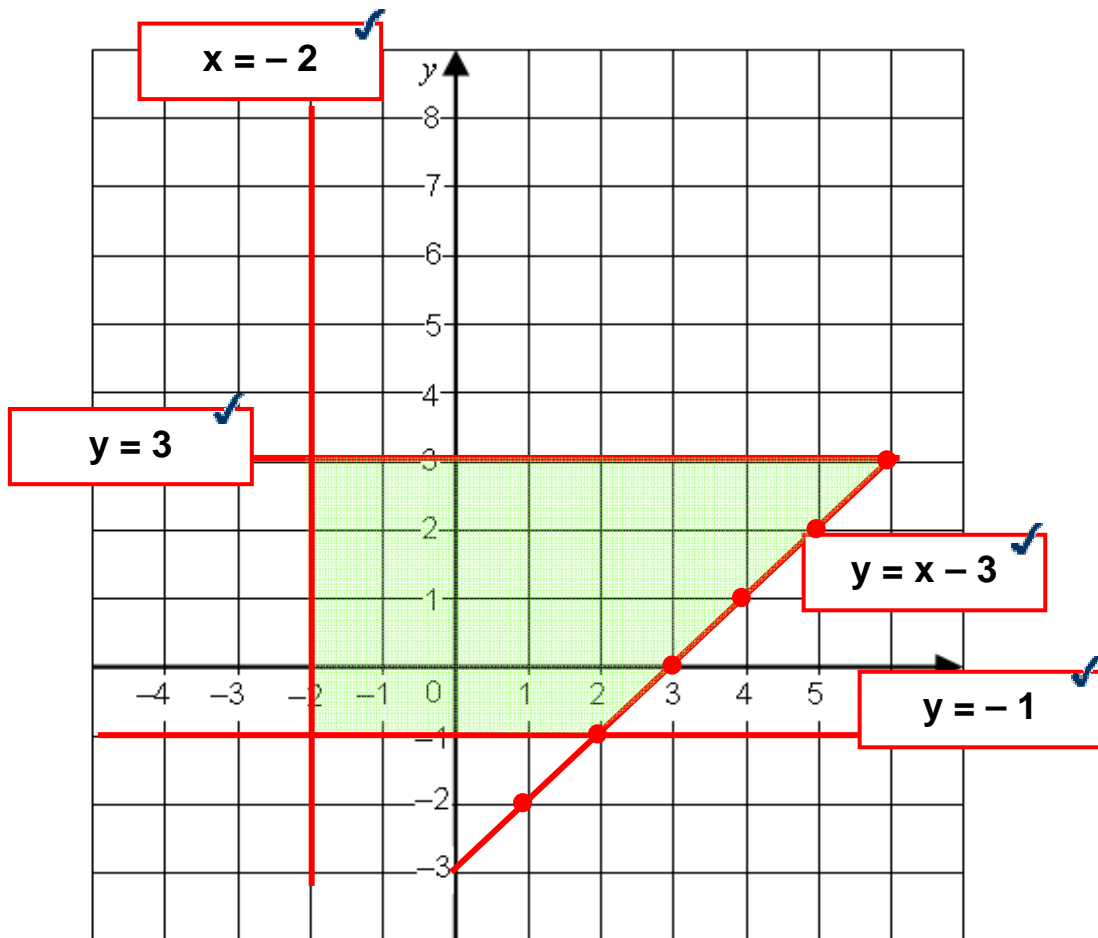
$$y = x - 3 \quad \text{for } x \text{ from } 1 \text{ to } 6$$

(1)

(1)

(3)

$x =$	1	2	3	4	5	6
$y =$	-2	-1	0	1	2	3



b) What is the name of the shape enclosed by the four lines?

trapezium

(1)

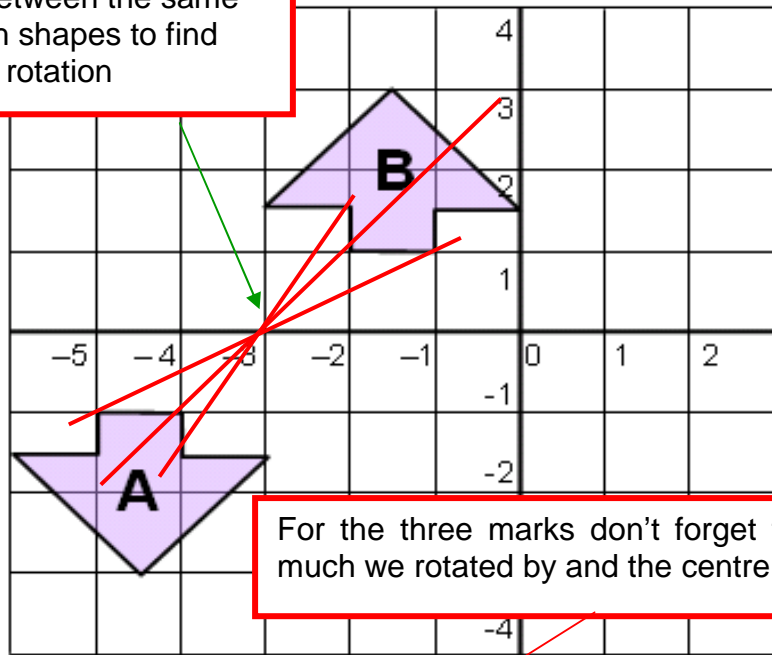
c) What is the area of this shape

24

(1)

8. a) Fully describe the single transformation which takes shape A to shape B

Draw lines between the same points in both shapes to find the centre of rotation



For the three marks don't forget to say how much we rotated by and the centre of rotation

This looks like a ROTATION by 180 degrees about the point  $(-3, 0)$  ..... (3)

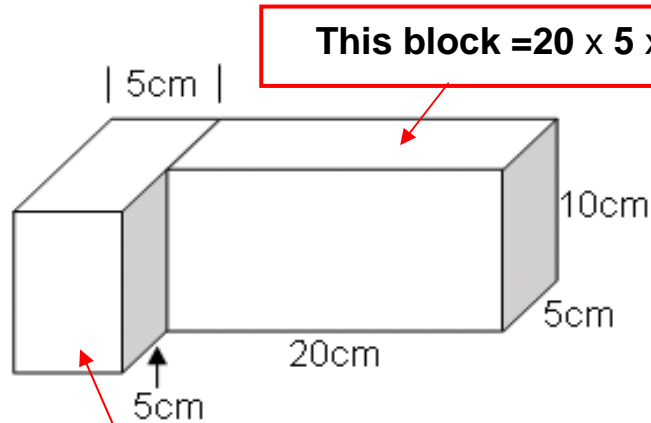
9. Estimate the value of  $\frac{15 \times 9.8}{1.49 - 0.99}$

$$\frac{15 \times 10}{0.5} = \frac{150}{0.5} = 300$$

300

(2)

10. Gaynor put two blocks together as shown



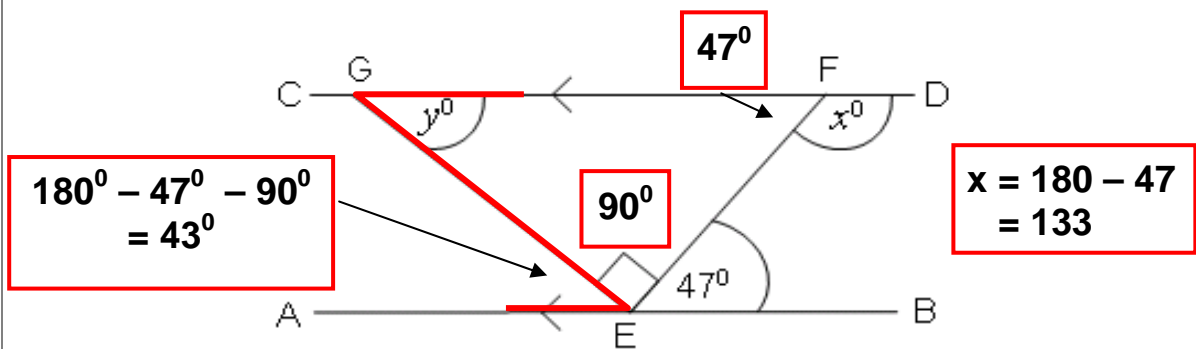
**This block =  $20 \times 5 \times 10 = 1000$**

What is the volume of the two blocks

**This block =  $5 \times 10 \times 10 = 500$**

..... **1500** <sup>✓</sup> cm<sup>3</sup> (2)

11. The diagram shows two parallel lines AB and CD and a triangle EFG.



Work out the sizes of angles  $x$  and  $y$

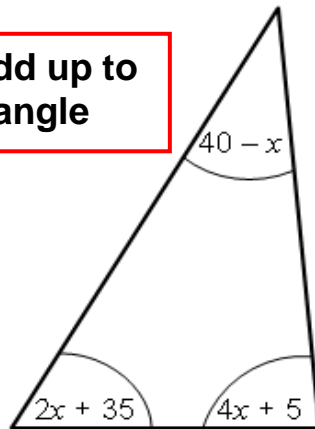
$x = \dots$  **133** <sup>✓</sup> (1)

$y = \dots$  **43** <sup>✓</sup> (1)



12. Three angles are shown in the triangle below.

All angles add up to  $180^\circ$  in a triangle



not to scale

- a) Write an equation for the sum of the total angles in the triangle in terms of  $x$ .

$$\begin{aligned} 2x + 35 + 4x + 5 + 40 - x &= 180 \\ 5x + 80 &= 180 \end{aligned}$$

$$5x + 80 = 180 \quad (2)$$

- b) Solve the equation to find  $x$

$$5x + 80 = 180 \text{ so } 5x = 100 \text{ so } x = 20$$

$$x = 20^\circ \quad (2)$$

- c) What is the size of the largest angle in the triangle.

$$4 \times 20 + 5$$

$$\text{largest angle} = 85^\circ \quad (1)$$

13. a) Work out  $1\frac{4}{7} + 2\frac{2}{3}$

**Add whole numbers:  $1 + 2 = 3$**

Give your answer as a fraction in its simplest form.

**Add fractions:  $\frac{4}{7} + \frac{2}{3} = \frac{12}{21} + \frac{14}{21} = \frac{26}{21} = 1\frac{5}{21}$**

**$4\frac{5}{21}$**  ✓

(2)

b) Work out  $2\frac{5}{8} \div 5\frac{2}{5}$

**Change to 8<sup>ths</sup>**

**Change to 5<sup>ths</sup>**

Give your answer as a fraction in its simplest form.

**$\frac{21}{8} \div \frac{27}{5} = \frac{21}{8} \times \frac{5}{27} = \frac{7}{8} \times \frac{5}{9}$**

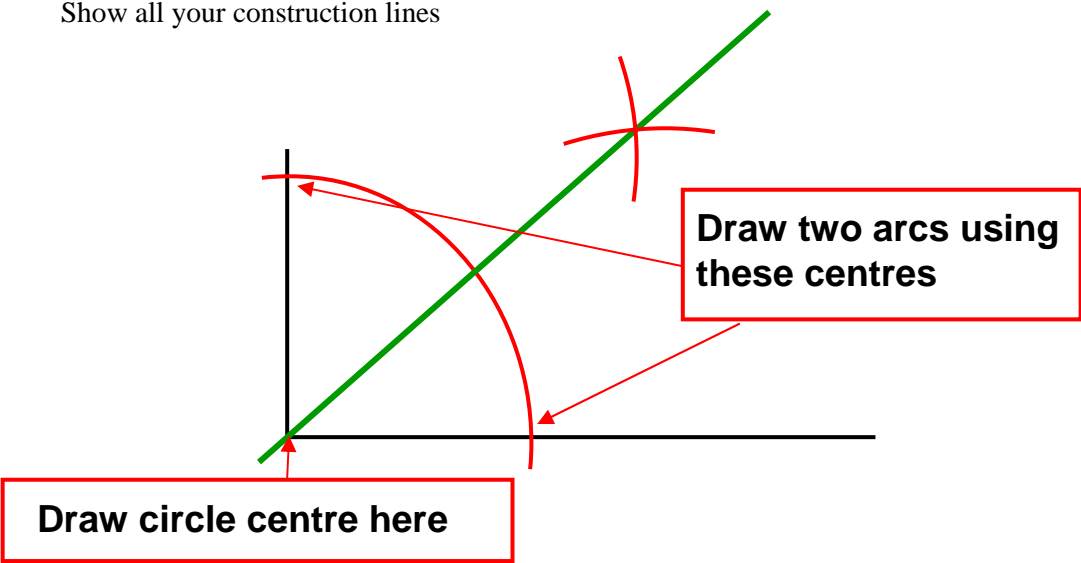
**$\frac{35}{72}$**  ✓

(2)

14. Using a compass and ruler construct an angle of  $45^\circ$

Use the right angle shown to help you.

Show all your construction lines



(2)

15. a) Simplify  $a \times a \times a \times a \times a$   **$a^5$**  ✓ (1)
- b) Expand and simplify  $4(x + 2y) + 3(4x - y)$   **$16x + 5y$**  ✓ (2)
- c) Factorise  $6y - 12$   **$6(y - 2)$**  ✓ (1)
- d) Factorise  $y^2 - 5y$   **$y(y - 5)$**  ✓ (1)
- e) Expand and simplify  $(2x - 3)^2$
- It's not  $4x^2 + 9$  expand  $(2x - 3)(2x - 3)$**   **$4x^2 - 12x + 9$**  ✓ (2)
- f) Solve  $5x - 10 = 18 - 3x$
- $8x = 28$**   **$x = 3.5$**  ✓ (2)
- g) Solve  $x^2 + 13x - 14 = 0$
- $(x + 14)(x - 1) = 0$**   **$x = 1$  or  $-14$**  ✓ (3)

16. Whilst in Switzerland Matthew bought a snowboard in a sale.

**Sale  
Snowboards  
15% off**

The **sale price** was 510 Swiss Francs (CHF).

Work out the **normal price** for the snowboard.



**You paid 85%**

so **0.85 of normal = sale**

$$\begin{array}{rcl} 0.85 \times N & = & S \\ N & = & \frac{510}{0.85} = 600 \end{array}$$

**600**

CHF..... (3)

17. a) Write as a power of 7

i)  $7^{10} \times 7^5$

**Add powers**

**$7^{15}$**

(1)

ii)  $\frac{7^3 \times 7^5}{7^2}$

**Add and subtract  
powers**

**$\frac{7^8}{7^2} = 7^6$**

(2)

- b) What is  $2^{-2}$  as a decimal

**$\frac{1}{2^2} = \frac{1}{4}$**

(1)

- c) Write down the reciprocal of 5

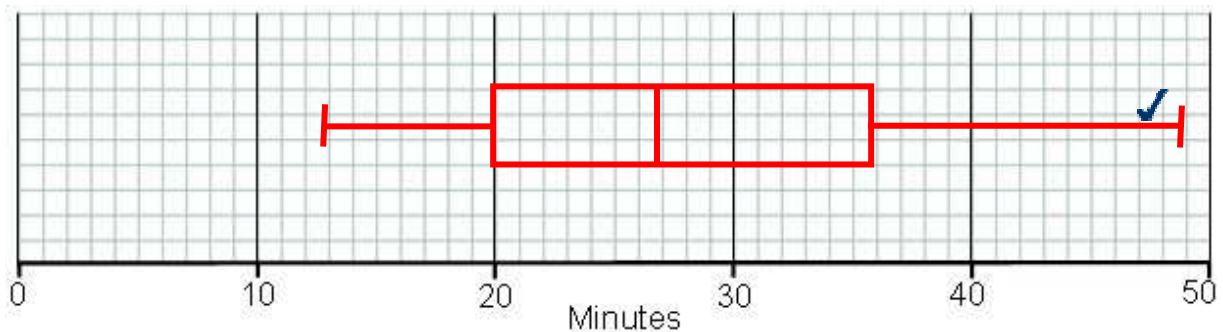
**$\frac{1}{5}$**

(1)

18. Mrs Dew set her students some homework. Each student recorded the time taken for them to do their homework. Mrs Dew used this information to work out the following table.

	Minutes
Shortest time	13
Lower quartile	20
Median	27
Upper Quartile	36
Longest time	49

Draw a box plot for this information on the grid below



(3)

19. At the supermarket, Henry buys **three** ready meals and **two** drinks for **£18.10**  
 In the same supermarket, Gaynor buys **five** ready meals and **three** drinks for **£29.90**  
 What is the cost of the ready meal and the cost of the drink

$$3R + 2D = 1810$$

Make simultaneous equations

$$5R + 3D = 2990$$

Multiply both to make D same

$$10R + 6D = 5980$$

Sub  $R = 550$  into equation to find D

$$9R + 6D = 5430$$

$$\text{Subtract to get } R = 550$$

Ready meal : £

5.50

Drink : £

0.80

(4)

20. A survey of 120 children was made to see how long they spent on Facebook each week.

The table below shows how long in hours the children spent.

Time (t hours)	Frequency
$0 < t \leq 5$	4
$5 < t \leq 10$	22
$10 < t \leq 15$	37
$15 < t \leq 20$	34
$20 < t \leq 25$	16
$25 < t \leq 30$	7

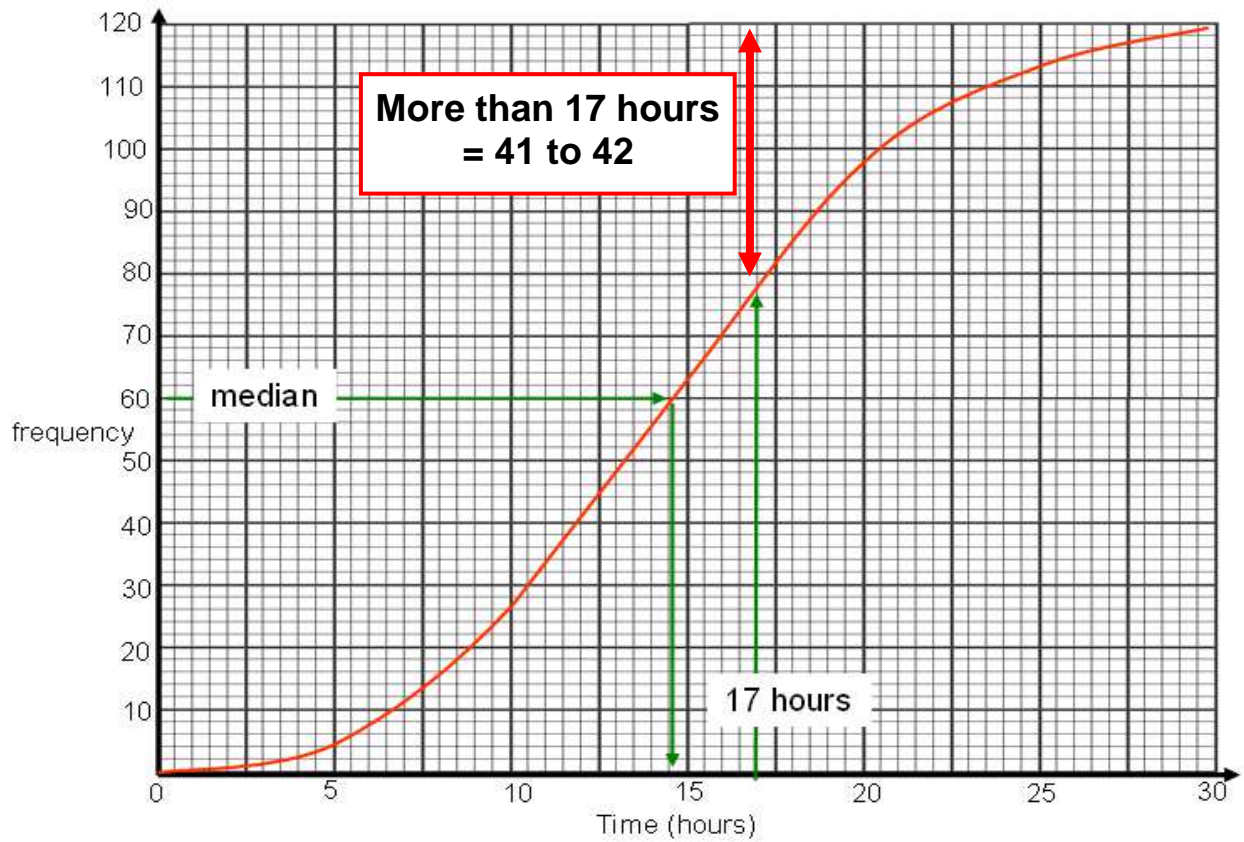
- a) Complete the cumulative frequency table below

Time (t hours)	Frequency
$0 < t \leq 5$	4
$0 < t \leq 10$	<b>26</b> ✓
$0 < t \leq 15$	<b>63</b>
$0 < t \leq 20$	<b>97</b>
$0 < t \leq 25$	<b>113</b>
$0 < t \leq 30$	<b>120</b>

**Running totals**

(1)

b) Use the table to plot the cumulative frequency graph below



(2)

c) Use your graph to estimate how many children spent longer than 17 hours on facebook per week.

**41 to 42** ✓

(1)

d) Estimate the median time that children spent on Facebook

**14 to 15 hours** ✓

(1)

21. The gravitational force  $F$  (Newton) between two masses is inversely proportional to the square of the distance  $d$  between them.

When  $d = 8$ ,  $F = 10$

- a) Find a formula for  $F$  in terms of  $d$ .

"To the square" means the value squared

Since  $F$  is inversely proportional to  $d$  squared we write this as  $F \propto \frac{1}{d^2}$

We can replace the  $\propto$  sign by  $= k$  where  $k$  is a constant. So  $F = k \frac{1}{d^2}$

If know that when  $d = 8$ ,  $F = 10$  and can use this to find  $k$ :

$$\text{So } F = k \frac{1}{d^2}$$

so

$$10 = k \frac{1}{8^2} \text{ so } k = 10 \times 64 = 640$$

We can rewrite the formula as

$$F = 640 \frac{1}{d^2}$$

$$F = \frac{640}{d^2}$$

(3)

- b) Hence or otherwise calculate  $F$  when  $d = 10$

Now we can work out  $F$  when  $d = 10$ , using the formula above

$$F = 640 \frac{1}{d^2}$$

$$\text{so } F = \frac{640}{100} = 6.4$$

6.4

(1)

More like this at

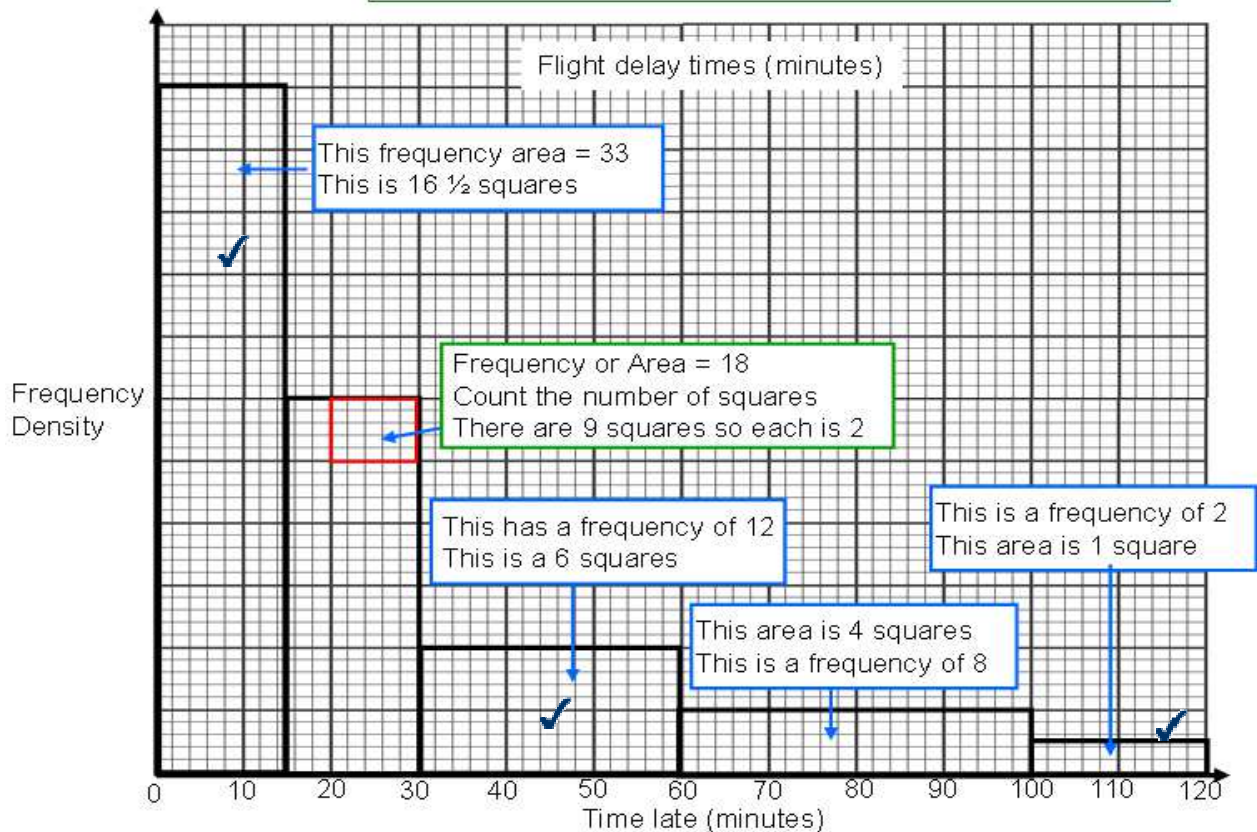
<http://www.mathsmadeeasy.co.uk/gcsemathsrevisionpapers.htm>



22. Delays in airplane take-offs was recorded for flights at an airport. The table and histogram for this information is shown below.

Flight delay (minutes)	Frequency
$0 < t \leq 15$	33
$15 < t \leq 30$	18
$30 < t \leq 60$	12
$60 < t \leq 100$	<b>8</b>
$100 < t \leq 120$	2

Remember: Frequency Density  $\times$  Interval (area) = Frequency



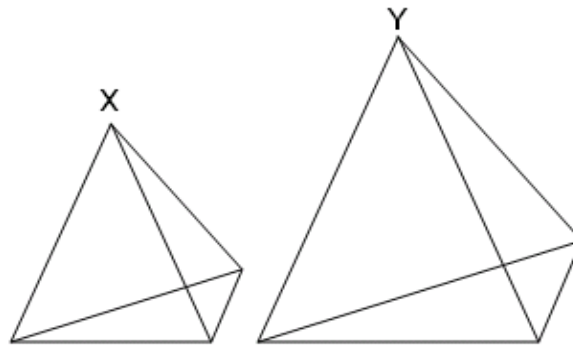
- a) Complete the table
- b) Complete the histogram

23. Two triangular based pyramids X and Y are mathematically similar.

The surface area of X is  $32 \text{ cm}^2$  and the surface area of Y is  $72 \text{ cm}^2$

The volume of Y is  $540 \text{ cm}^3$ .

Calculate the volume of X



**Find area scaling factor SF from ratio of areas**

$$\text{SF Area: } 32: 72 = 4:9$$

$$\text{Length SF: } = \sqrt{4}: \sqrt{9} = 2: 3$$

$$\text{Volume SF: } = 2^3: 3^3 = 8: 27$$

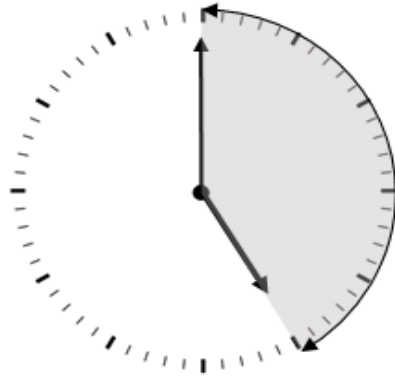
$$\text{Volume X} = \frac{8}{27} \times 540 = 8 \times 20 = 160$$

**160** ✓

..cm<sup>3</sup>

(4)

24.



Clock Face – 36cm diameter

A circular clock face is 36 cm in diameter. The clock shows 5pm

- a) Calculate the area between the minute hand and hour hand of the clock  
Leave your answer in terms of  $\pi$

**Fraction of circle is 5 out of 12 divisions**

**Area circle =  $\pi r^2$  radius = 18cm**

**Area of fraction is  $\frac{5}{12} \times 18 \times 18 \times \pi = 5 \times 3 \times 9 \times \pi$**

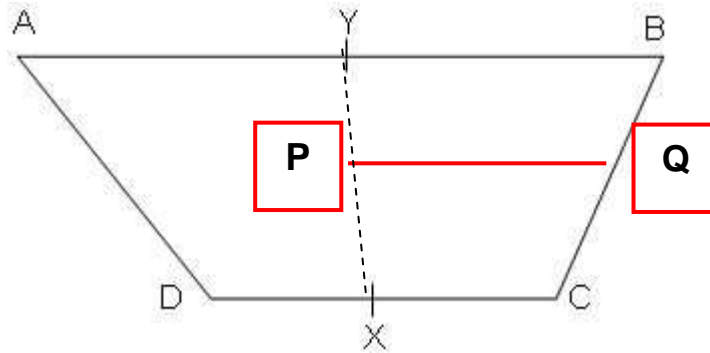
.....  **$135\pi$**   cm<sup>2</sup> (2)

- b) Calculate the distance of the arc between the minute hand and hour hands.  
Leave your answer in terms of  $\pi$

**Circumference =  $\pi D = 36 \times \pi$**   
**Fraction circumference =  $\frac{5}{12} \times 36 \times \pi = 15\pi$**

.....  **$15\pi$**   cm (2)

25.



ABCD is a trapezium with AB parallel to DC

$$AD = 3b \quad AB = 6a \quad DC = 4a$$

Y is the mid point of AB and X is the mid point of DC

a) Find the vector BC in terms of a and b

$$BC = BA + AD + DC = -6a + 3b + 4a = -2a + 3b$$

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

(1)

b) Find the vector XY in terms of a and b

$$XY = \frac{1}{2} CD + DA + \frac{1}{2} AB = -2a - 3b + 3a$$

$$= \dots a - 3b$$

(2)

P is the mid point of YX and Q is the midpoint of BC

c) Prove that PQ is parallel to DC

$$\begin{aligned} PQ &= PX + XC + CQ \\ &= -\frac{1}{2}(a - 3b) + 2a + \frac{1}{2}(2a - 3b) \\ &= 2\frac{1}{2}a \end{aligned}$$

DC is  $4a$  so both vectors only have 'a' vector so must be parallel

(2)

26. a) What is  $\sqrt{20}$  in the form  $p\sqrt{5}$

P is an integer

$$\sqrt{20} = \sqrt{4} \sqrt{5} = 2\sqrt{5}$$

$$2\sqrt{5}$$

(2)

b) Rationalise the denominator

$$\frac{2 + \sqrt{3}}{\sqrt{3}}$$

Multiply top and bottom by  $\sqrt{3}$

$$\frac{\sqrt{3}}{\sqrt{3}} \frac{(2 + \sqrt{3})}{\sqrt{3}} = \frac{2}{3} \sqrt{3} + 1$$

$$\frac{2}{3} \sqrt{3} + 1$$

(2)