1. Frank, Mary and Seth shared some sweets in the ratio 4 : 5 : 7
Seth got 18 more sweets than Frank. ← 'The difference between Seth and Frank'

Work out the total number of sweets they shared.

F M S
4 : 5 : 7

7 − 4 = 3 ← 'Ratio difference'
×6 (1)
18 ← 'Real life difference'

$3x = 18$
$\frac{3x}{3} = \frac{18}{3}$
$x = 6$

4 + 5 + 7 = 16 ← 'Ratio total'
(1)
16 × 6 = 96 ← 'Real life total'

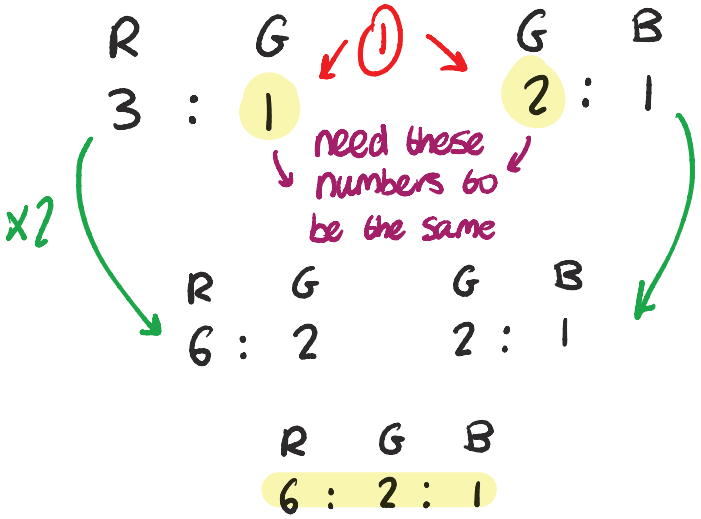
96 (1)

[3]

2. In a box of pens, there are

three times as many red pens as green pens
and two times as many green pens as blue pens.

For the pens in the box, write down
the ratio of the number of red pens to the number of green pens to the number of blue pens.



6 : 2 : 1 (1)

2 marks

3. White shapes and black shapes are used in a game.
Some of the shapes are circles.
All the other shapes are squares.

The ratio of the number of white shapes to the number of black shapes is 3 : 7

The ratio of the number of white circles to the number of white squares is 4 : 5

The ratio of the number of black circles to the number of black squares is 2 : 5

Work out what fraction of all the shapes are circles.

W : B = 3 : 7 } 10 parts.

$\frac{3}{10}$ are white. $\frac{7}{10}$ are black.

C : S = 4 : 5 } 9 parts

$\frac{4}{9}$ of all white shapes are circles

$\frac{4}{9} \times \frac{3}{10}$ = circles

white

(1) $\frac{4}{9} \times \frac{3}{10} = \frac{12}{90} = \frac{2}{15}$ (÷6)

C : S = 2 : 5 } 7 parts

$\frac{2}{7}$ of all black shapes are circles

$\frac{2}{7} \times \frac{7}{10}$ = circles

(1) black

$\frac{2}{7} \times \frac{7}{10} = \frac{14}{70} = \frac{1}{5}$ (÷14)

(1) $\frac{2}{15} + \frac{1}{5} = \frac{4}{30} + \frac{6}{30} = \frac{10}{30} = \frac{1}{3}$ (÷10)

$\frac{1}{3}$ (1)

.....

(Total for Question is 4 marks)

4. On Saturday, some adults and some children were in a theatre.
The ratio of the number of adults to the number of children was 5 : 2

Each person had a seat in the Circle or had a seat in the Stalls.

$\frac{3}{4}$ of the children had seats in the Stalls.
117 children had seats in the Circle. → 117 = ¼

There are exactly 2600 seats in the theatre.

On this Saturday, were there people on more than 60% of the seats?
You must show how you get your answer.

Total number of children = 117 × 4 = 468 children (1)

A : C
= 5 : 2 (×234)
(×234) 1170 : 468

Total number of people = 468 + 1170 = 1638 (1)

Total number of adults = 1170 adults (1)

60% of 2600 = 0·6 × 2600 = 1560 seats. (1)

Yes, there were people on more than 60% of the seats because 1638 > 1560. (1)

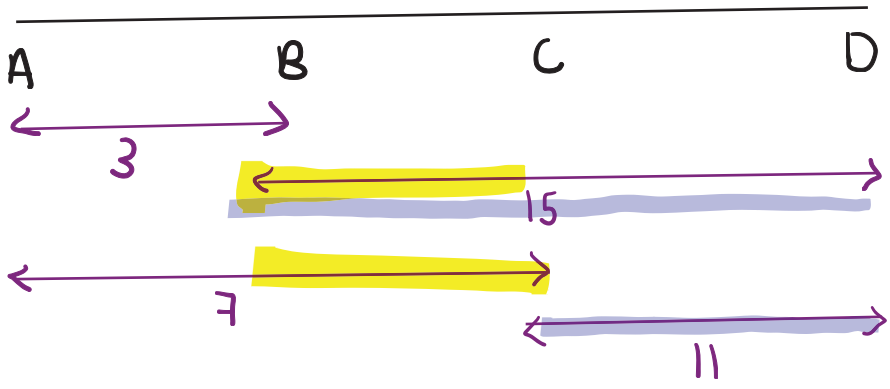
(Total for Question is 5 marks)

5. The points A, B, C and D lie in order on a straight line.

$AB:BD = 1:5 = 6$
$AC:CD = 7:11 = 18$ ×3

Work out $AB:BC:CD$ (1)

AB : BD = 3 : 15. AC : CD = 7 : 11



BC = 15 − 11 = 4. (1)

AB : BC : CD
= 3 : 4 : 11 (1)

3 : 4 : 11

(Total for Question is 3 marks)

6. Kiaria is 7 years older than Jay.
Martha is twice as old as Kiaria.
The sum of their three ages is 77

Find the ratio of Jay's age to Kiaria's age to Martha's age.

Let x be Jay's age

Jay $= x$
Kiaria $= x + 7$
Martha $= 2(x+7)$
$= 2x + 14$

J : K : M
$x : x + 7 : 2x + 14$

$14 : 14 + 7 : 2(14) + 14$
$14 : 21 : 42$

$x + x + 7 + 2x + 14 = 77$
$4x + 21 = 77$
$4x = 56$
$x = 14$

14 : 21 : 42

(Total for Question is 4 marks)

7. The ratio $(y + x) : (y - x)$ is equivalent to $k : 1$

Show that $y = \dfrac{x(k+1)}{k-1}$

$k : 1$

$(\times n)\ (\times n)$

$y + x : y - x$

$\dfrac{k}{1} = \dfrac{y+x}{y-x}$ ✓

$k = \dfrac{y+x}{y-x}$

$\times(y-x) \quad \times(y-x)$

$k(y-x) = y+x$

$ky - kx = y + x$

$+kx \quad +kx$

$ky = y + x + kx$

$-y \quad -y$

$ky - y = x + kx$ ✓

$y(k-1) = x(k+1)$

$\div(k-1) \quad \div(k-1)$

$y = \dfrac{x(k+1)}{k-1}$ ✓

(Total for Question is 3 marks)

$\frac{432}{990} = \frac{216}{495} = \frac{24}{55}$

$x = 0.436363636\ldots$

$10x = 4.363636\ldots$ ✓

$100x = 43.636363\ldots$

$1000x = 436.363636\ldots$

$1000x - 10x = 436.36 - 4.36$ ✓

$990x = 432$

$\div 990 \quad \div 990$

$x = \frac{432}{990}$

$x = \frac{24}{55}$ ✓

8. There are only blue cubes, yellow cubes and green cubes in a bag.

There are

twice as many blue cubes as yellow cubes
and four times as many green cubes as blue cubes.

Hannah takes at random a cube from the bag.

Work out the probability that Hannah takes a yellow cube.

B : Y
2 : 1

G : B
4 : 1 ✓
(×2) (×2)
8 : 2

G : B : Y
8 : 2 : 1 ✓

Green = 8
Blue = 2
Yellow = 1
Total = 11

$\frac{1}{11}$ ✓

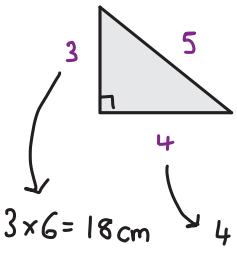
(Total for Question is 3 marks)

9. The perimeter of a right-angled triangle is 72 cm.
The lengths of its sides are in the ratio 3 : 4 : 5

Work out the area of the triangle.

5 must represent the hypotenuse as it is the longest side.

What factor does this ratio need to be scaled up by to give a perimeter of 72cm?



$3 + 4 + 5 = 12$ ← perimeter of Δ with side lengths of ratio in its simplest form (3:4:5)

$\frac{72}{12} = 6$ (1)

Side length × 6 = side length of Δ with 72cm perimeter

$3 \times 6 = 18$cm $4 \times 6 = 24$cm (1)

Area of Δ with 72cm perimeter:

$\frac{1}{2}$ base × height $= \frac{1}{2} \times 24 \times 18$ (1)

$= 216\ cm^2$

(1)

216 ..... cm^2

(Total for Question is 4 marks)

Difference of two squares (D.O.T.S)

$(a+b)(a-b) = a^2 + ab - ab - b^2$

$= a^2 - b^2$

$(a+b)(a-b)$

← use information from part a

$a^2 - b^2$

$a = 3c^2 + 4$

$b = 3c^2 - 2$ (1)

$a^2 - b^2 = (a+b)(a-b)$ ← seen in part a

$= ((3c^2+4)+(3c^2-2))((3c^2+4)-(3c^2-2))$ (1)

$= (2 \times 3c^2 + 2) \times 6$

$= 12 \times 3c^2 + 12$

$= 12(3c^2+1)$

$12(3c^2+1)$ (1)

10. There are only red counters, blue counters and purple counters in a bag.
The ratio of the number of red counters to the number of blue counters is 3 : 17

Sam takes at random a counter from the bag.
The probability that the counter is purple is 0.2

Work out the probability that Sam takes a red counter.

$P(\text{red or blue}) = 1 - P(\text{purple})$

$= 1 - 0.2$

$= 0.8$

red : blue
3 : 17

$P(\text{red}) = \frac{3}{3+17} = \frac{3}{20}$ (1)

red in ratio

sum of ratio

P(red) when it could either be red or blue

$P(\text{red overall}) = \frac{3}{20} \times 0.8 = 0.12$ (1)

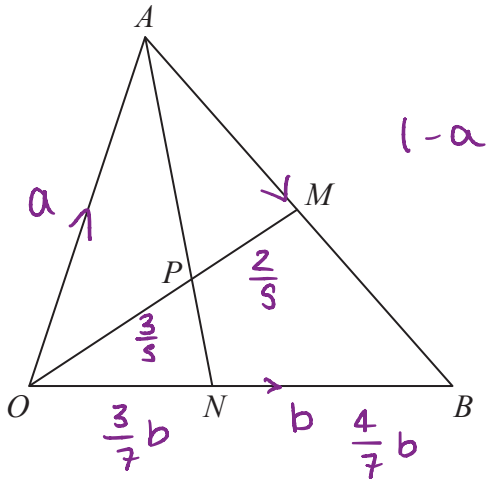
P(it is red or blue)

P(red) when either red or blue

0.12 (1)

(Total for Question is 3 marks)

11.



OAB is a triangle.
OPM and *APN* are straight lines.
M is the midpoint of *AB*.

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

$OP : PM = 3 : 2$

Work out the ratio $ON : NB$

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

$\overrightarrow{AM} = \overrightarrow{MB} = \frac{1}{2}(-a+b)$
$= -\frac{1}{2}a + \frac{1}{2}b$

$\overrightarrow{OM} = \overrightarrow{OA} + \overrightarrow{AM}$
$= a - \frac{1}{2}a + \frac{1}{2}b$
$= \frac{1}{2}a + \frac{1}{2}b$ ✓

$\overrightarrow{OP} = \frac{3}{5}\overrightarrow{OM}$
$= \frac{3}{5}(\frac{1}{2}a + \frac{1}{2}b)$
$= \frac{3}{10}a + \frac{3}{10}b$

$\overrightarrow{AP} = -\overrightarrow{OA} + \overrightarrow{OP}$
$= -a + \frac{3}{10}a + \frac{3}{10}b$
$= \frac{7}{10}a + \frac{3}{10}b$ ✓

$\overrightarrow{AN} = x\overrightarrow{AP}$
$= x(-\frac{7}{10}a + \frac{3}{10}b)$

$\overrightarrow{AN} = -\overrightarrow{OA} + \overrightarrow{ON}$
$= -a + 4b$

$-\frac{7}{10} \times a + \frac{3}{10} \times b = -a + 4b$

$-\frac{7}{10}x = -1$

$x = \frac{10}{7}$

$\frac{3}{10}x = 4$

$\frac{3}{10} \times \frac{10}{7} = 4$ $\frac{3}{7} = 4$ ✓

$\overrightarrow{ON} = \frac{3}{7}b$

3 : 4 ✓

(Total for Question is 5 marks)

12. A shop sells packs of black pens, packs of red pens and packs of green pens.

There are

2 pens in each pack of black pens
5 pens in each pack of red pens
6 pens in each pack of green pens

On Monday,

number of packs of black pens sold : number of packs of red pens sold : number of packs of green pens sold = 7 : 3 : 4

A total of 212 pens were sold.

Work out the number of green pens sold.

Ratio of the number of pens of each colour sold:

B : R : G

(2 × 7) : (5 × 3) : (6 × 4) (1)

= 14 : 15 : 24 ⟹ 53 parts in total.

Number of green pens sold:

(1) $\frac{24}{53}$ × 212 (1) = 96 (1)

↳ proportion of green pens sold.

96

(Total for Question is 4 marks)

13. £360 is shared between Abby, Ben, Chloe and Denesh.

The ratio of the amount Abby gets to the amount Ben gets is 2 : 7

Chloe and Denesh each get 1.5 times the amount Abby gets.

Work out the amount of money that Ben gets.

A : B
= 2 : 7

1.5 × 2 = 3

so C : D
= 3 : 3

(1)

A : B : C : D (1)

= 2 : 7 : 3 : 3 = 15 parts.

15 parts = £360

÷15 ↓ 1 part = £24 (1) ↓ ÷15

money that Ben gets: (1)

£24 × 7 = £168.

£ 168

(Total for Question is 4 marks)

14. The circumference of circle **B** is 90% of the circumference of circle **A**.

(a) Find the ratio of the area of circle **A** to the area of circle **B**.

	A	Scale Factor	B
Circumference	10	→ ×0.9 →	9
Area	100	→ ×0.9^2 →	81

(1)

Area of A : Area of B
= 100 : 81

(1)

100 : 81

(2)

Square **E** has sides of length e cm.
Square **F** has sides of length f cm.

The area of square **E** is 44% greater than the area of square **F**.

(b) Work out the ratio $e : f$

	F	Scale Factor	E
Length	10	→ ×$\sqrt{1.44}$ →	12
Area	100	→ ×1.44 →	144

(1)

e : f
length of E : length of F
= 12 : 10
= 6 : 5

(1)

6 : 5

(2)

(Total for Question is 4 marks)

15. There are some small cubes and some large cubes in a bag.
The cubes are red or the cubes are yellow.

The ratio of the number of small cubes to the number of large cubes is 4 : 7 (11 parts)

The ratio of the number of red cubes to the number of yellow cubes is 3 : 5 (8 parts)

(a) Explain why the least possible number of cubes in the bag is 88

Because the LCM of 11 and 8 is 88.

(1)

(1)

All the small cubes are yellow.

(b) Work out the least possible number of large yellow cubes in the bag.

Least possible number of cubes = 88.

	SMALL	LARGE	TOTAL
RED	0	33	33
YELLOW	32	23	55
TOTAL	32	56	88

(1)

S : L = 4 : 7

R : Y = 3 : 5

Total number of small cubes = $\frac{4}{11} \times 88 = 32$

Total number of large cubes = $\frac{7}{11} \times 88 = 56$ (1)

Total number of red cubes = $\frac{3}{8} \times 88 = 33$

Total number of yellow cubes = $\frac{5}{8} \times 88 = 55$

(1) 23

(3)

(Total for Question is 4 marks)

16. There are 60 people in a choir.
Half of the people in the choir are women.

The number of women in the choir is 3 times the number of men in the choir.
The rest of the people in the choir are children.

the number of children in the choir : the number of men in the choir = n : 1

Work out the value of n.
You must show how you get your answer.

w = Number of women
C = Number of children
M = Number of men

$w + C + M = 60$

$w = 60 \div 2 = 30$

work this out using info from the question

$w = 3m$ ~ $3m = 30$
$m = \frac{30}{3}$
$m = 10$ (1)

$30 + C + 10 = 60$
$C = 60 - 10 - 30$
$= 20$ (1)

$m = 10$
$w = 30$
$C = 20$

(1) C : M
20 : 10 ÷10
2 : 1 ÷10

$\therefore n = 2$

$n =$ 2 (1)

17. Carlo puts tins into small boxes and into large boxes.

He puts 6 tins into each small box. → num small box = $\frac{1200}{6} = 200$
He puts 20 tins into each large box. → num large box = $\frac{1800}{20} = 90$

Carlo puts a total of 3000 tins into the boxes so that

number of tins in small boxes : number of tins in large boxes = 2 : 3

Carlo says that less than 30% of the boxes filled with tins are large boxes.

Is Carlo correct?
You must show all your working.

1 share = $\frac{3000}{5} = 600$

tins in small : tins in large

2 : 3 → 2+3=5

×6 ↓ ↓ ×6

1200 : 1800

proportion of boxes that are large : $\frac{90}{290} = 0.31 \rightarrow 31\%$

31% > 30% and no.

(Total for Question is 5 marks)

18. Rosie, Matilda and Ibrahim collect stickers.

$$\frac{\text{number of stickers Rosie has}}{} : \frac{\text{number of stickers Matilda has}}{} : \frac{\text{number of stickers Ibrahim has}}{} = 4:7:15$$

Ibrahim has 24 more stickers than Matilda.

Ibrahim has more stickers than Rosie.
How many more?

R : M : I
4 : 7 : 15
$4x : 7x : 15x = 26x$

26x stickers in total.

Ibrahim has $15x$ stickers
↳ Ibrahim also has 24 more stickers than Matilda.

Matilda has $7x$ stickers.

∴ Ibrahim has $(7x + 24)$ stickers.

$15x = 7x + 24$

$8x = 24$ (÷8)

$x = 3$ (÷8) (1)

(1) 33

(Total for Question is 3 marks)

R : M : I
$4x : 7x : 15x$
$4(3) : 7(3) : 15(3)$
$12 : 21 : 45$ (1)

Ibrahim has 45 stickers, while Rosie has 12 stickers.

∴ Ibrahim has 33 more stickers than Rosie.