1 A delivery company has a total of 160 cars and vans.

the number of cars : the number of vans = 3 : 7

Each car and each van uses electricity or diesel or petrol.

$\frac{1}{8}$ of the cars use electricity.
25% of the cars use diesel.
The rest of the cars use petrol.

Work out the number of cars that use petrol.
You must show all your working.

cars : vans → total

3 : 7 → 10

160 vehicles ÷ 10 = 16 ✓ (1)

3 : 7

×16 ↓ ×16

48 cars : 112 vans

✓ (1)

Petrol : $1 - \frac{1}{8} - \frac{1}{4} = \frac{5}{8}$ ✓ (1)

$\frac{5}{8} \times 48 = 30$ ✓ (1)

✓ (1)

30

(Total for Question 1 is 5 marks)

2 Cormac has some sweets in a bag.
The sweets are lime flavoured or strawberry flavoured or orange flavoured.

In the bag

$$\begin{matrix}\text{number of lime}\\ \text{flavoured sweets}\end{matrix} : \begin{matrix}\text{number of strawberry}\\ \text{flavoured sweets}\end{matrix} : \begin{matrix}\text{number of orange}\\ \text{flavoured sweets}\end{matrix} = 9 : 4 : x$$

Cormac is going to take at random a sweet from the bag.

The probability that he takes a lime flavoured sweet is $\frac{3}{7}$

Work out the value of x.

L : S : O

9 : 4 : x

Total

9 + 4 + x or 13 + x

Lime $\frac{9}{13+x} = \frac{3}{7}$ ✓①

$63 = 39 + 3x$ ✓① ✓①

$24 = 3x$ so $x = 8$

$x =$ 8

(Total for Question 2 is 3 marks)

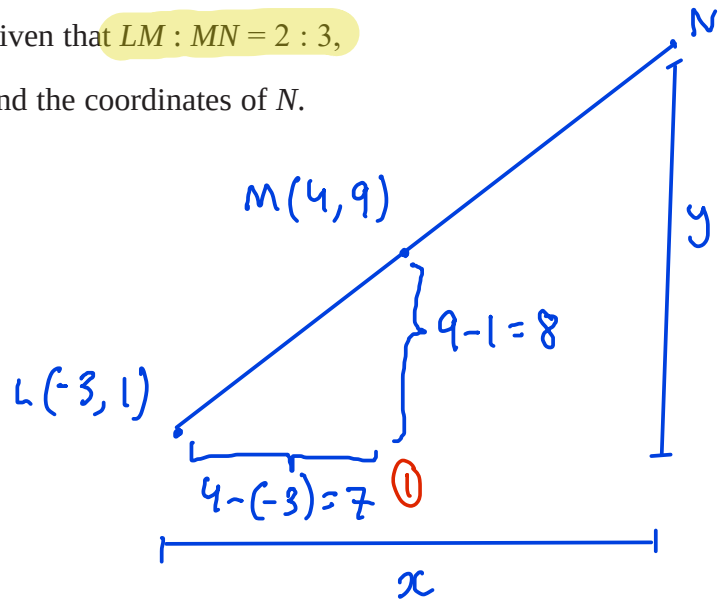
3 The points L, M and N are such that LMN is a straight line.

The coordinates of L are $(-3, 1)$

The coordinates of M are $(4, 9)$

Given that $LM : MN = 2 : 3$,

find the coordinates of N.



Method: find horizontal & vertical components of LM, then use the ratio to find horiz. & vert. components of LN, then use $\overrightarrow{ON} = \overrightarrow{OL} + \overrightarrow{LN}$.

$N(-3+17.5, 1+20)$ ①

$N(14.5, 21)$ ①

7 is $\frac{2}{5}$ of x

$\therefore x = 7 \times \frac{5}{2} = 17.5$ ①

8 is $\frac{2}{5}$ of y

$\therefore y = 8 \times \frac{5}{2} = 20$

(14.5 , 21)

(Total for Question 3 is 4 marks)

4 Rick, Selma and Tony are playing a game with counters.

Rick has some counters.
Selma has twice as many counters as Rick.
Tony has 6 counters less than Selma.

In total they have 54 counters.

the number of counters Rick has : the number of counters Tony has = 1 : p

Work out the value of p.

let n be the number of counters Rick has

∴ Selma has $2n$ counters

∴ Tony has $2n-6$ counters (1)

In total they have 54 counters

$n + 2n + 2n-6 = 54$ (1)

$5n-6 = 54$

$5n = 60$

$n = 12$ (1)

so Rick has 12 counters and Tony has $2(12)-6$
$= 18$ counters

Rick : Tony
12 : 18 (1)
1 : $\frac{18}{12}$

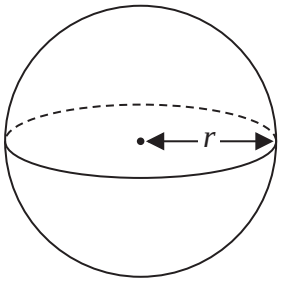
we want this in the form 1 : p so divide both sides by 12.

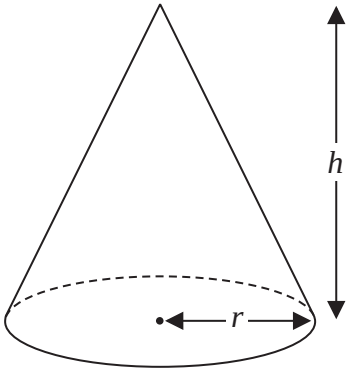
$p = \frac{18}{12} = 1.5$ (1)

$p =$ 1.5

(Total for Question 4 is 5 marks)

5 Here is a solid sphere and a solid cone.





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

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

All measurements are in cm.

The volume of the sphere is equal to the volume of the cone.

(a) Find $r : h$
Give your answer in its simplest form.

volumes equal:

$\frac{4}{3}\pi r^3 = \frac{1}{3}\pi r^2 h$ (1)

$\times 3$

$4\pi r^3 = \pi r^2 h$

$\div \pi$

$4r^3 = r^2 h$

$\div r^2$

$4r = h$

h is four times r so h is bigger

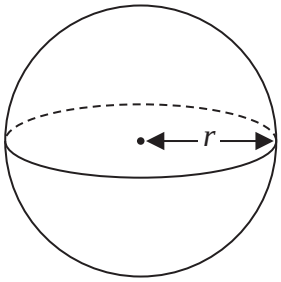
$r : h$

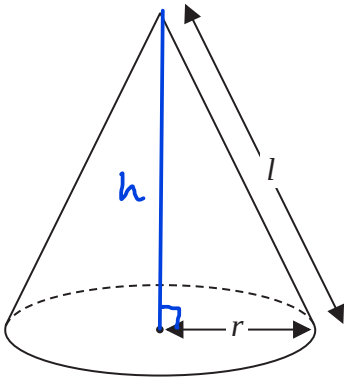
$1 : 4$ (1)

1:4

(2)

Here is a different solid sphere and a different solid cone.





Surface area of sphere = $4\pi r^2$

Curved area of cone = πrl

All measurements are in cm.

The surface area of the sphere is equal to the **total** surface area of the cone.

(b) Find $r : h$

Give your answer in the form $1 : \sqrt{n}$ where n is an integer.

surface area = SA

SA of sphere = $4\pi r^2$

SA of cone = $\pi rl + \pi r^2$

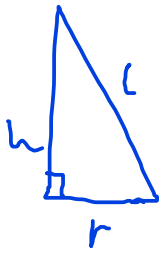
$4\pi r^2 = \pi rl + \pi r^2$ (1)

$4r = l + r$

$l = 3r$

sub in $l = 3r$

from right angled triangle:



$h = \sqrt{l^2 - r^2}$

$h = \sqrt{(3r)^2 - r^2}$ (1)

$h = \sqrt{8r^2}$

$h = \sqrt{8}\,r$ (1)

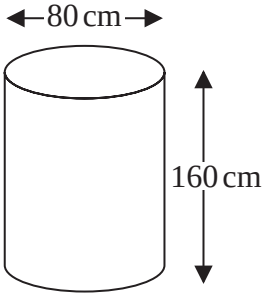
$r : h$

$1 : \sqrt{8}$ (1)

(4)

(Total for Question 5 is 6 marks)

6 Karina has 4 tanks on her tractor.
Each tank is a cylinder with diameter 80 cm and height 160 cm.



The 4 tanks are to be filled completely with a mixture of fertiliser and water.

The fertiliser has to be mixed with water in the ratio 1 : 100 by volume.
Karina has 32 litres of fertiliser.

1 litre = 1000 cm^3

Has Karina enough fertiliser for the 4 tanks?
You must show how you get your answer.

Volume of the cylinder = $\pi r^2 h$ r = radius, h = height

we have $r = \frac{80}{2} = 40$ cm

$h = 160$ cm

$\therefore$ volume is $\pi(40)^2(160) = 256000\pi$ cm^3 $\div 1000$

$= 256\pi$ litres (1)

So four tanks have a volume of $4 \times 256\pi = 1024\pi$ litres (1)

we need fertiliser : water
1 : 100

$1 + 100 = 101$

$1024\pi \div 101 = 31.85...$ (1)

So Karina needs at least 31.9 litres of fertiliser.

$32 > 31.9$ so (1) Karina has enough fertiliser

(Total for Question 6 is 4 marks)

7 There are four boxes on a shelf, **A**, **B**, **C** and **D**.

(1) The total weight of **A** and **B** is 3 times the total weight of **C** and **D**.

(2) The weight of **A** is $\frac{2}{3}$ of the weight of **B**.

(3) The weight of **C** is 75% of the weight of **D**.

Find the ratio

weight of **A** : weight of **B** : weight of **C** : weight of **D**

(1) $(A+B)=3(C+D)$ (1)

(2) $A=\frac{2}{3}B \overset{\times 3}{\Rightarrow} 3A=2B \Rightarrow$ A : B = 2 : 3

(3) $C=\frac{3}{4}D \overset{\times 4}{\Rightarrow} 4C=3D \Rightarrow$ C : D = 3 : 4 (1)

sub in $A=\frac{2}{3}B$ and $C=\frac{3}{4}D$ into $(A+B)=3(C+D)$: (1)

$\frac{2}{3}B+B=3\left(\frac{3}{4}D+D\right)$

$\frac{5}{3}B=\frac{21}{4}D$ (×12)

$20B=63D$

$B:D$

$63:20$

A : B
2 : 3 (×21)
42 : 63

C : D
3 : 4 (×5)
15 : 20

A : B : C : D
42 : 63 : 15 : 20

(1)

42 : 63 : 15 : 20

(Total for Question 7 is 4 marks)

8 $2a : 5c = 6 : 25$
$4b : 7c = 20 : 21$

Show that $a + b : b + c = 17 : 20$

$\frac{2a}{5c} = \frac{6}{25}$ $\qquad$ $\frac{4b}{7c} = \frac{20}{21}$

$2a(25) = 6(5c)$ $\qquad$ $4b(21) = 20(7c)$

$50a = 30c$ $\qquad$ $84b = 140c$

$\therefore a = \frac{3}{5}c$ (1) $\qquad$ $\therefore b = \frac{5}{3}c$

$a + b : b + c$

$\frac{3 \times 3}{3 \times 5}c + \frac{5 \times 5}{3 \times 5}c : \frac{5}{3}c + c$ (1)

$\frac{9}{15}c + \frac{25}{15}c : \frac{8}{3}c$

$\therefore \frac{34}{15}c : \frac{8}{3}c$

$\therefore \frac{34}{15}c : \frac{40}{15}c$ (1)

$\times 15$ then $\div 2$

$\therefore 17 : 20$ (shown)

(Total for Question 8 is 3 marks)