Q31.

John has an empty box.
He puts some red counters and some blue counters into the box.

The ratio of the number of red counters to the number of blue counters is 1 : 4 x

Linda takes at random 2 counters from the box.

The probability that she takes 2 red counters is $\frac{6}{155}$

How many red counters did John put into the box?

r and r

$$\frac{x}{5x} \times \frac{x-1}{5x-1} = \frac{6}{155}$$

$$\frac{x}{5x} = \frac{1}{5} \qquad \frac{1}{5} \times \frac{x-1}{5x-1} = \frac{x-1}{25x5}$$

$$\frac{x-1}{25x5} = \frac{6}{155}$$

$$155(x-1) = 6(25x-5)$$

$$155x - 155 = 150x - 30$$

$$5x = 125$$

$$x = 25$$

25

(Total for question = 4 marks)

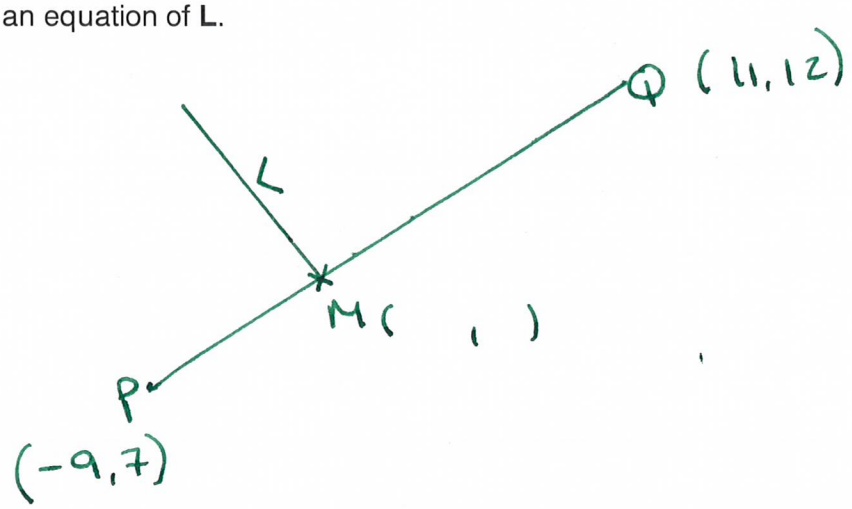
Q30.

P has coordinates (–9, 7)
Q has coordinates (11, 12)

M is the point on the line segment *PQ* such that *PM* : *MQ* = 2 : 3

Line **L** is perpendicular to the line segment *PQ*.
L passes through *M*.

Find an equation of **L**.



$\frac{11+9}{5} \times 2 = 8$

$-9+8=-1$ x co-ordinate $=-1$

$\frac{12-7}{5} \times 2 = 2$ y co-ordinate $= 9$

$7+2 = 9$

gradient of PQ

$\frac{7-12}{-9-11} = \frac{-5}{-20} = 1/4$

$\therefore$ gradient of L $= -4$

$y = -4x + c$

$9 = -4 \times -1 + c$

$c = 5$

$y = -4x + 5$

or $y = 5 - 4x$.

(Total for question = 5 marks)

Q15.

A pendulum of length L cm has time period T seconds. T is directly proportional to the square root of L.

$T \propto \sqrt{L}$ so $T = k\sqrt{L}$

The length of the pendulum is increased by 40%. Work out the percentage increase in the time period.

$T = k\sqrt{1.4L}$

% change $= \sqrt{1.4}$

$= 18.3\%$

.....18.3..... %

(Total for question is 3 marks)

Q14.

It takes 12 men 5 days to complete a job.

(a) Work out how many days it would take 3 men to complete the same job.

inversly proportional

÷4 (12 men = 5 days) ×4
3 men = 20 days

20 days

(2)

(b) (i) State one assumption you made in working out your answer.

Each man works at the same rate.

(1)

(ii) How will your answer be affected if your assumption is **not** correct?

If men work slower, it will take longer, if they work quicker it will be faster.

(1)

(Total for question = 4 marks)

Q17.

The surface gravity of a planet can be worked out using the formula

$$g = \frac{6.67 \times 10^{-11}\ m}{r^2}$$

where

m kilograms is the mass of the planet
r metres is the radius of the planet

For the Earth and Jupiter here are the values of *m* and *r*.

Earth	Jupiter
$m = 5.98 \times 10^{24}$	$m = 1.90 \times 10^{27}$
$r = 6.378 \times 10^{6}$	$r = 7.149 \times 10^{7}$

Work out the ratio of the surface gravity of Earth to the surface gravity of Jupiter.
Write your answer in the form 1: *n*

Earth = 9.805234578

Jupiter = 24.79641183

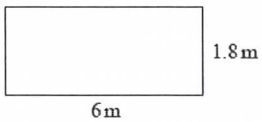
1 : 2.52889532

1 : 2.53

(Total for question = 3 marks)

Q18.

The diagram shows a rectangular wall.



Frank is going to cover the wall with rectangular tiles.
Each tile is 60 cm by 30 cm.

$\frac{3}{5}$ of the tiles will be white. = 36

60 tiles in total

Some of the tiles will be green.
The rest of the tiles will be blue.

The ratio of the number of green tiles to the number of blue tiles will be 1 : 3

(a) Assuming there are no gaps between the tiles, how many tiles of each colour will Frank need?

24 tiles 1 : 3

1 + 3 = 4
24 ÷ 4 = 6
6 × 1 = 6 green
6 × 3 = 18 blue

white tiles 36
green tiles 6
blue tiles 18

(5)

Frank is told that he should leave gaps between the tiles.

(b) If Frank leaves gaps between the tiles, how could this affect the number of tiles he needs?

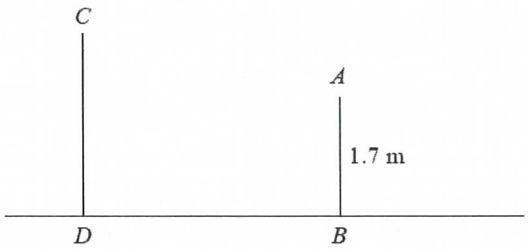
Fewer tiles needed.

(1)

(Total for question = 6 marks)

Q13.

The diagram shows two vertical posts, *AB* and *CD*, on horizontal ground.



AB = 1.7 m
CD : *AB* = 1.5 : 1

The angle of elevation of *C* from *A* is 52°

Calculate the length of *BD*. Give your answer correct to 3 significant figures.

$CD = 1.5 \times 1.7 = 2.55$

$CE = 2.55 - 1.7 = 0.85$

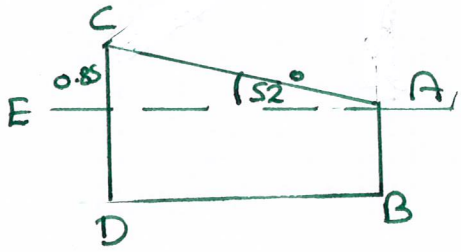
$\tan 52° = \frac{0.85}{DB}$

$DB = \frac{0.85}{\tan 52°}$

$= 0.6640927825$

0.664 .....m

(Total for question is 4 marks)



Q12.

On a farm

the number of cows and the number of sheep are in the ratio 6 : 5
the number of sheep and the number of pigs are in the ratio 2 : 1

The total number of cows, sheep and pigs on the farm is 189

How many sheep are there on the farm?

cows : sheep
6 : 5
12 : 10 ×2

sheep : pigs
×5 2 : 1
10 : 5

so cows : sheep : pigs
12 : 10 : 5

12+10+5 = 27

189÷27 = 7

Sheep = 7×10 = 70

70 sheep.

(Total for question = 3 marks)

Work out as a single fraction

$$\frac{2}{x-3} - \frac{1}{x+4}.$$

Answer ..... [3]

① Find common denominator

Example

$\frac{3}{4} - \frac{1}{2}$ $\quad$ $\frac{6}{8} - \frac{4}{8}$

Multiply to give common denominator

$$\frac{2(x+4) - 1(x-3)}{(x-3)(x+4)}$$

② Expand & simplify

$$\frac{2x+8-x+3}{x^2+4x-3x-12}$$

$$\frac{x+11}{x^2+x-12}$$

Q32.

$a = \sqrt{7} + \sqrt{c}$ and $b = \sqrt{63} + \sqrt{d}$ where c and d are positive integers.

Given that $c : d = 1 : 9$
find, in its simplest form, the ratio $a : b$

$\therefore \sqrt{d} = \sqrt{9c} = \sqrt{9} \times \sqrt{c} = 3\sqrt{c}$

$\sqrt{7} + \sqrt{c} : \sqrt{63} + 3\sqrt{c}$

$\sqrt{7} + \sqrt{c} : \sqrt{9} \times \sqrt{7} + 3\sqrt{c}$

$1 + \sqrt{c} : 3 + 3\sqrt{c}$

1 : 3

(Total for question = 3 marks)