Edexcel GCSE

Centre Number

Candidate Number

Applications of Mathematics
Unit 2: Applications 2
For Approved Pilot Centres ONLY

Higher Tier

Wednesday 13 June 2012 – Morning
Time: 1 hour 45 minutes

Paper Reference
5AM2H/01

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

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.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.

Information

- The total mark for this paper is 100
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed.

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.
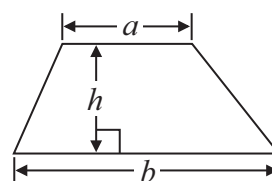
Turn over ▶

PEARSON

Formulae: Higher Tier

You must not write on this formulae page.
Anything you write on this formulae page will gain NO credit.

Volume of prism = area of cross section × length

Area of trapezium = $\frac{1}{2}(a + b)h$

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

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

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

Curved surface area of cone = $\pi r l$

In any triangle *ABC*

The Quadratic Equation
The solutions of $ax^2 + bx + c = 0$
where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

Sine Rule $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine Rule $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle = $\frac{1}{2} ab \sin C$

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1 Jim buys 3 portions of chips.
   The total cost is £2.85

   Emma buys fish and 2 portions of chips.
   The total cost is £4.80

   (a) Work out the cost of the fish.

   £ ....
   (3)

   Emma and Dan share the cost of £4.80 in the ratio 5 : 3

   (b) Work out how much Emma and Dan each pay.

   Emma   £ ....

   Dan   £ ....
   (3)

   (Total for Question 1 is 6 marks)

*2 Tina is driving her car at a speed of 13.3 m/s.
She is at a distance of 25 m from a stop sign.

The greatest stopping distance, *s* metres, of Tina's car can be found using the formula

$$s = \frac{v^2}{2a}$$

where

        v m/s is the speed of the car,
        a m/s² is the deceleration of the car when braking.

The deceleration of Tina's car when braking is 3.86 m/s².
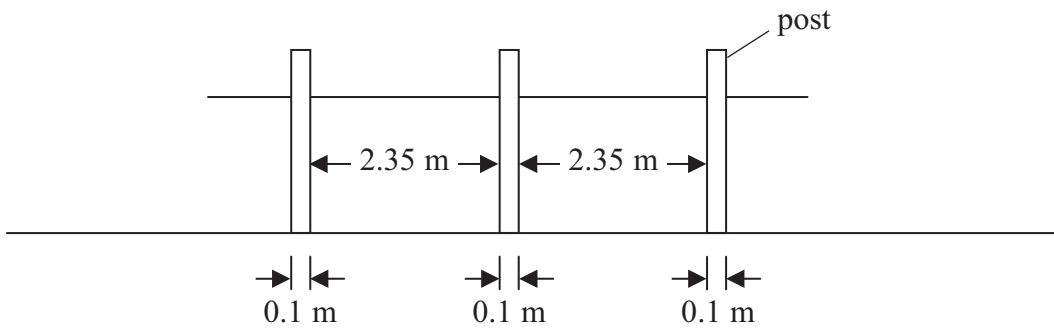
Will Tina be able to stop the car before the stop sign?

(Total for Question 2 is 3 marks)

3   Adam is a farmer.
   He is building a fence of length 250 m.

   Here is a diagram showing a part of the fence.

Diagram **NOT**
accurately drawn

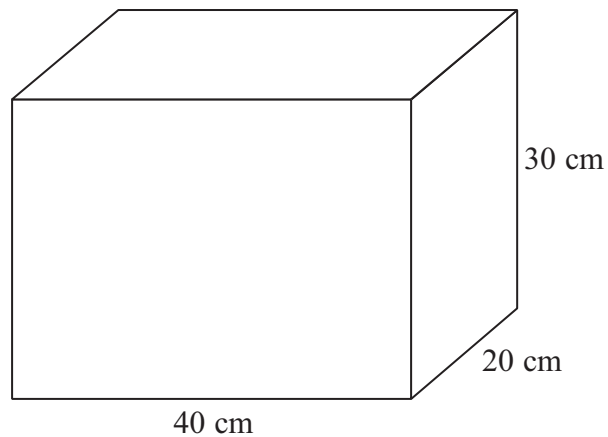The distance between posts is 2.35 m.
The width of each post is 0.1 m.

Work out the total number of posts needed to build the fence of length 250 m.

....

(Total for Question 3 is 3 marks)

*4   Here is a solid wooden building block in the shape of a cuboid.

Diagram **NOT** accurately drawn

30 cm

20 cm

40 cm

Carlo has 3 of these blocks.
He is going to paint each of the 3 blocks.
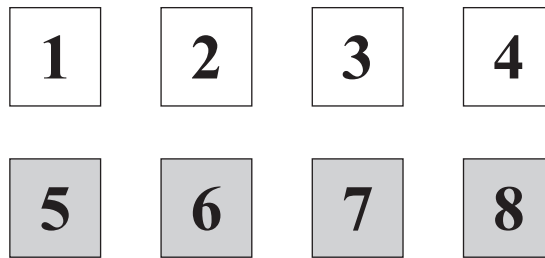
A tin of paint covers 20 000 cm^2.
Carlo has only one tin of paint.

Has Carlo got enough paint for the 3 blocks?
You must show all your working.

(Total for Question 4 is 4 marks)

5 Mark has 4 white cards and 4 grey cards.
There is a number on each card, as shown below.

| 1 | 2 | 3 | 4 |

| 5 | 6 | 7 | 8 |

Mark mixes up the white cards.
He puts the cards on the table so that the numbers are hidden.

Mark mixes up the grey cards.
He puts the cards on the table so that the numbers are hidden.

Mark and Jean play a game with all of these cards.

Mark asks Jean to take at random one white card and one grey card.

(a) Write down all the possible combinations of the pairs of numbers that Jean can take.

....

....

....

....

(2)

Jean wins the game when the numbers on the two cards add up to more than 9

Mark and Jean are going to play this game 80 times.
Mark will mix up the white cards and mix up the grey cards after each game.

(b) Estimate the number of games that Jean will win.

....

(3)

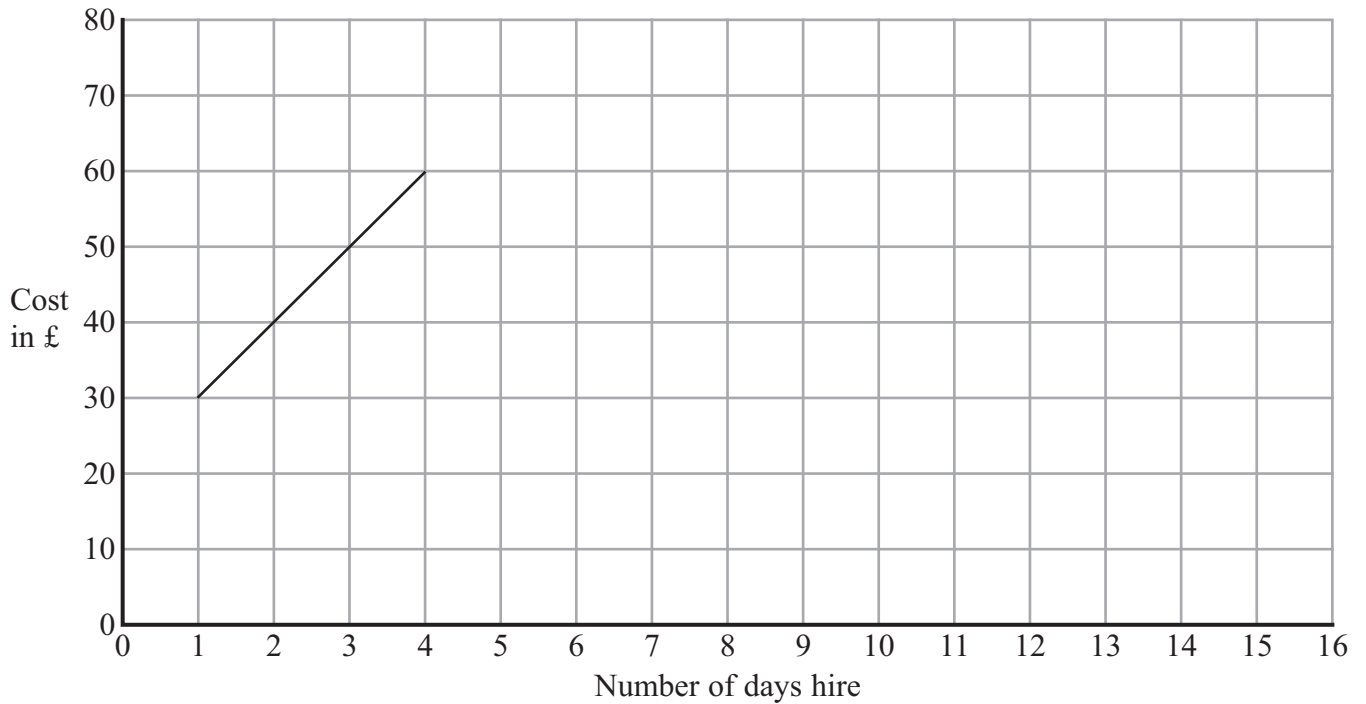**(Total for Question 5 is 5 marks)**

6 Bob's Shop has cement mixers for hire.
Here are the costs of hiring a cement mixer from Bob's Shop.

Bob's Shop

1 to 4 days hire: a fixed charge of £20 + £10 per day

More than 4 days hire: a fixed charge of £60 + £1.25 per day after the first 4 days

---

The graph shows some information about the cost of hiring a cement mixer from
1 to 4 days.

(a) On the grid, complete the graph to show the cost of hiring a cement mixer
for up to 16 days.

(2)

P40683A0824

Fred's Shop also has cement mixers for hire.
Here are the costs of hiring a cement mixer from Fred's Shop.

Fred's Shop
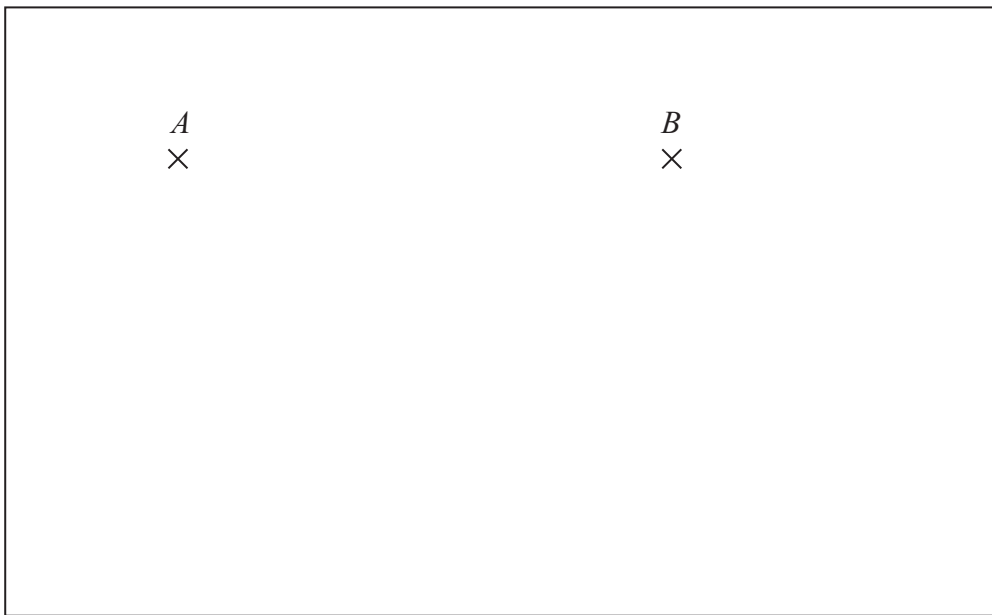
a fixed charge of £10 + £5 per day

Jim is going to hire a cement mixer.

*(b) When is the cost of hiring a cement mixer the same from Bob's Shop and from Fred's Shop?

(3)

(Total for Question 6 is 5 marks)

*7 The diagram shows a map of a field.
The scale of the map is 1 cm represents 20 m.

Wind turbines

A
✕

B
✕

A and B are two wind turbines in the field.

A third wind turbine is to be put in this field.
There must be at least 100 m between wind turbines.

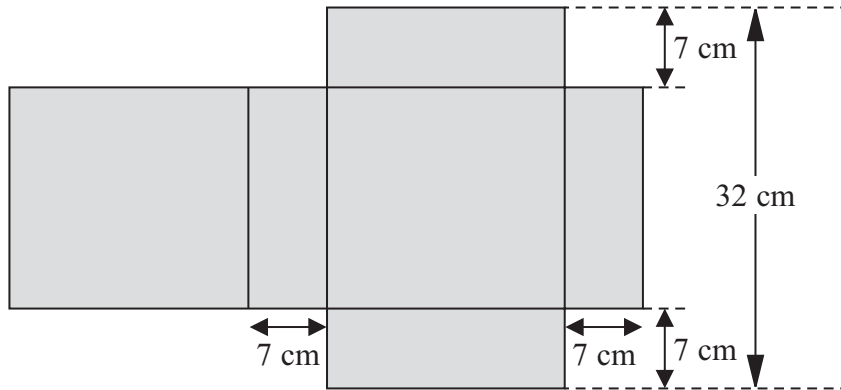Show, by shading, where the third wind turbine can be put.

(Total for Question 7 is 3 marks)

8 A cardboard box is in the shape of a cuboid.
The box has a square base and a square lid.

The diagram shows a net of this box.

Diagram **NOT**
accurately drawn

7 cm

32 cm

7 cm

7 cm

7 cm

Peter makes nets of this box from cardboard.
He has a square piece of cardboard of side 1 m.

(a) Work out the greatest number of these nets Peter can make.

....

(3)

P 4 0 6 8 3 A 0 1 0 2 4

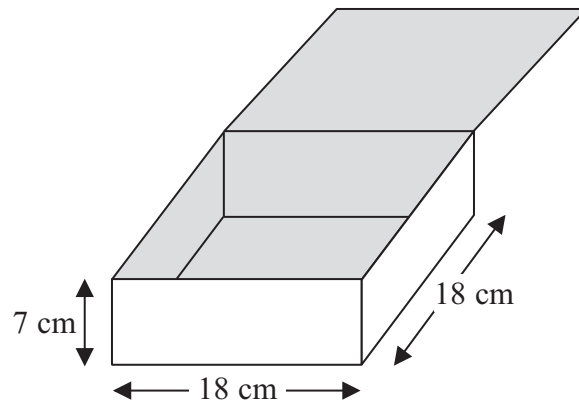Each net is folded to make a box.

Diagram **NOT** accurately drawn

7 cm

18 cm

18 cm

Peter wants to put as many 2 cm cubes into the box as possible.

He needs to close the lid.

(b) Work out the greatest number of 2 cm cubes Peter can put into the box.

....

(3)

(Total for Question 8 is 6 marks)

9 Michelle is x years old.
Angela is 5 years older than Michelle.

The sum of their ages, in years, is less than 50

(a) Write down, in terms of x, an inequality to show this information.

....

(2)

(b) Work out the oldest age that Michelle can be.
Give your answer as a whole number of years.

.... years

(3)

(Total for Question 9 is 5 marks)

10 In a raffle there is one winning ticket.

250 tickets are sold.
One ticket will be chosen at random.

Gemma buys one ticket.

(a) Work out the probability that Gemma will **not** win.
   Give your answer as a decimal.

....
(3)

Ellie buys some of the raffle tickets.

The probability that Ellie has the winning ticket is 0.06
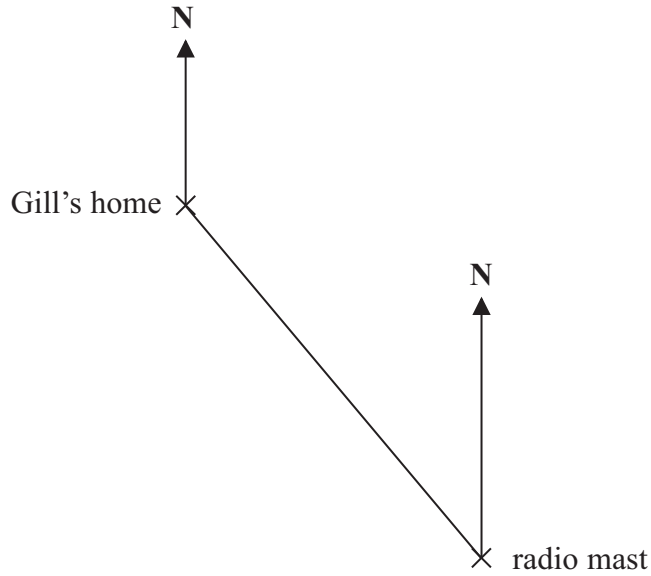
(b) How many tickets has Ellie?

....
(2)

(Total for Question 10 is 5 marks)

11 The accurate diagram shows the position of a radio mast and the position of Gill's home.

N

Gill's home ✗

N

✗ radio mast

(a) What is the bearing of Gill's home from the radio mast?

.... °

(1)

Malcolm's home is

due East of Gill's home,
on a bearing of 040° from the radio mast.

(b) On the diagram, mark the position of Malcolm's home with a cross (**X**).

(2)

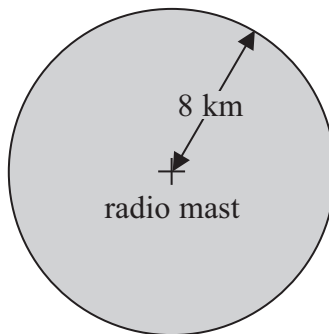A signal from the radio mast has a range of 8 km, as shown in the diagram.

8 km

radio mast

Diagram **NOT**
accurately drawn

(c) Calculate the area of the shaded region.
Give your answer correct to 3 significant figures.

.... km²

(2)

This diagram shows the position of a church *C*.

N   Diagram **NOT** accurately drawn

2.5 km

C

1.6 km
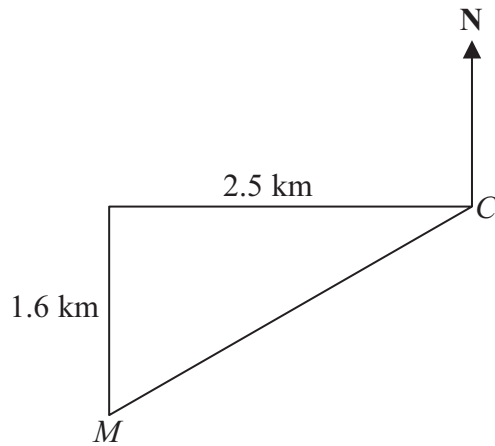
M

Munir's house (*M*) is 2.5 km West and 1.6 km South of the church.

(d) Work out the 3-figure bearing of Munir's house from the church.
Give your answer to the nearest degree.

°

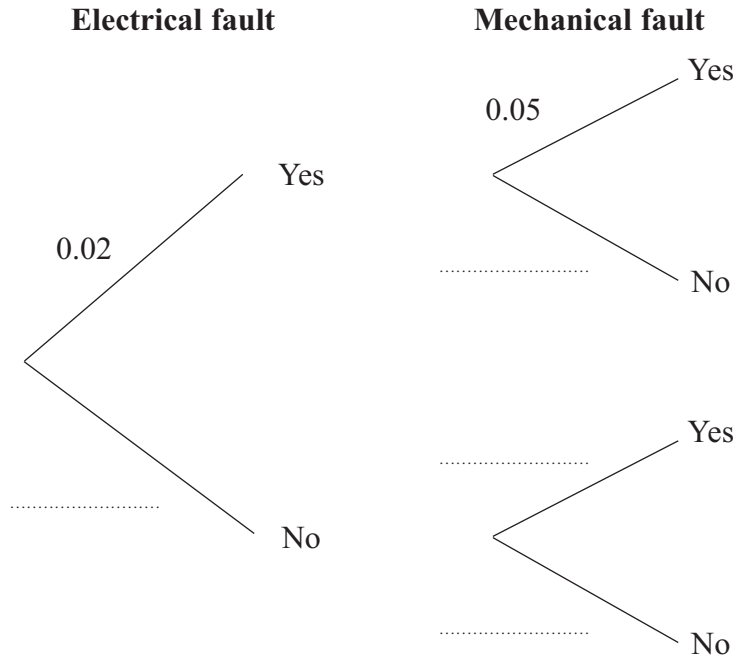...

(4)

(Total for Question 11 is 9 marks)

12 Icetown makes fridges.

The probability that an Icetown fridge will have an electrical fault is 0.02
The probability that an Icetown fridge will have a mechanical fault is 0.05

(a) Complete the decision tree diagram.

Electrical fault   **Mechanical fault**

(2)

Coolbox also makes fridges.

The probability that a Coolbox fridge will have **no** electrical fault and **no** mechanical fault is 0.93

Janet wants to buy a fridge with the least risk of any fault.

*(b) Which make of fridge should Janet buy, an Icetown fridge or a Coolbox fridge?

(3)

(Total for Question 12 is 5 marks)

13 Shane throws a ball into the air.

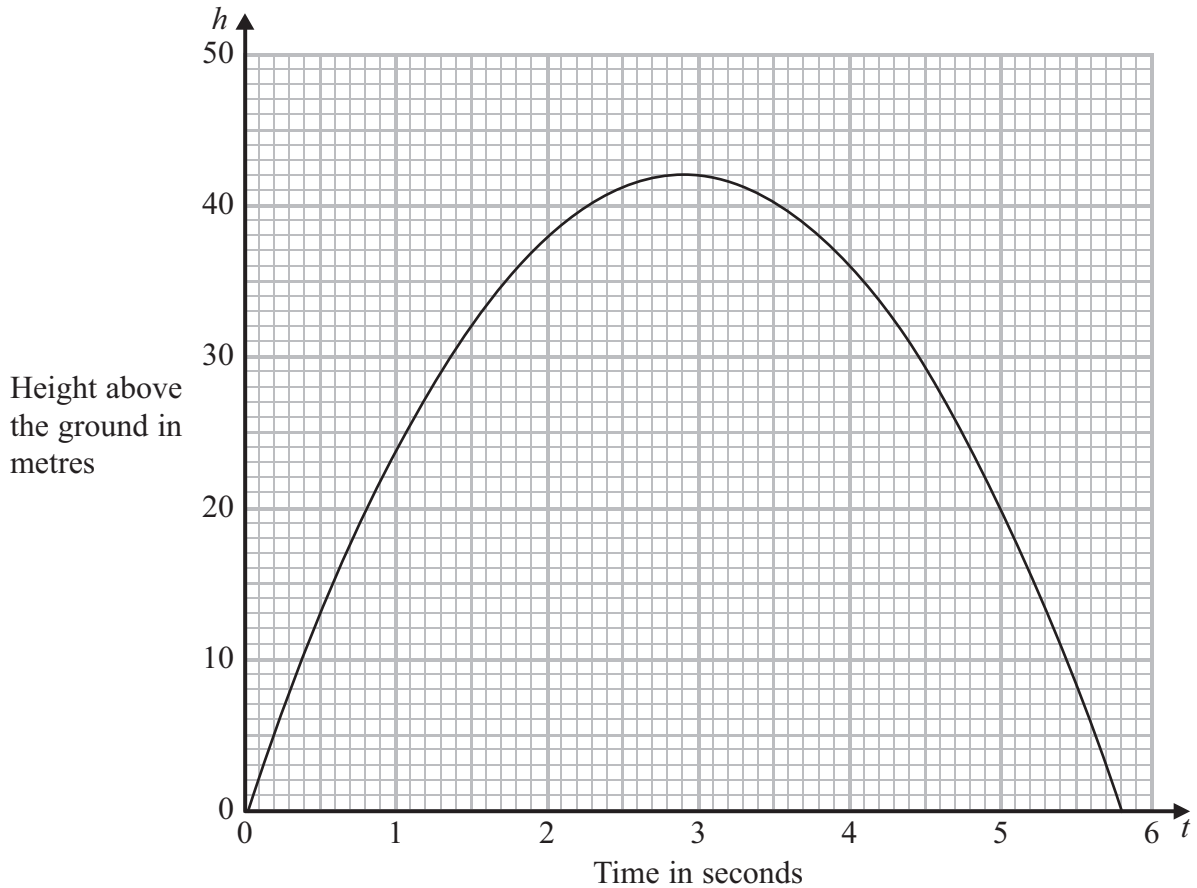The height of the ball above the ground is given by the formula

$$h = 29t - 5t^2$$

where

   h is the height, in metres, of the ball above the ground.
   t is the time, in seconds, after the ball has been thrown.
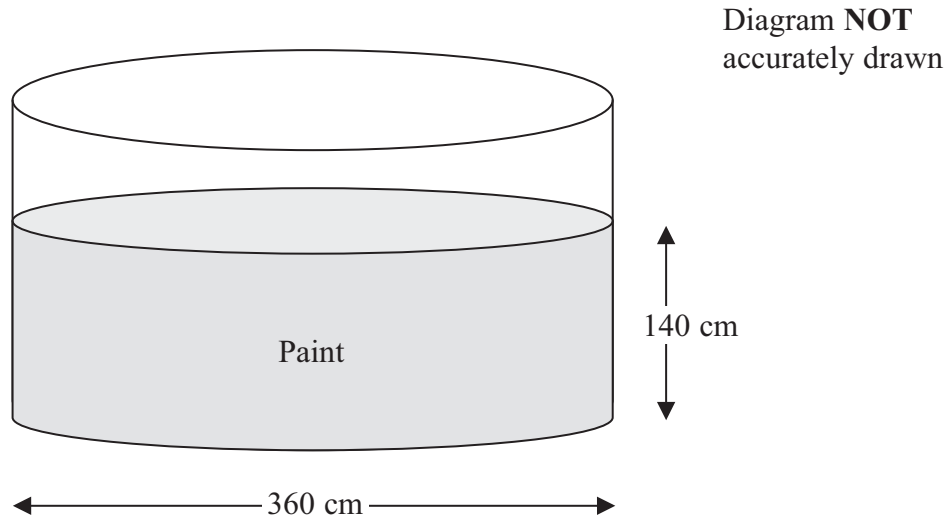
The diagram shows the graph of $h = 29t - 5t^2$

Use the graph to find the length of time the ball is more than 36 metres above the ground.

.... seconds

(Total for Question 13 is 3 marks)

14 A paint company stores paint in a tank.
The tank is a cylinder.

Diagram **NOT**
accurately drawn

Paint

140 cm

360 cm

The cylinder has a diameter of 360 cm.
The depth of the paint in the cylinder is 140 cm.

(a) Work out the number of litres of paint in the cylinder.
Give your answer to the nearest litre.
1 litre = 1000 cm³.

.... litres

(3)

The paint is poured into 1 litre cans.
The mass of an empty can of paint is 350 grams.

The density of the paint is 0.58 grams/cm³.

(b) Work out the mass of a 1 litre can when full with paint.

.... grams

(2)

(Total for Question 14 is 5 marks)

15 The diagram shows the position of a hot air balloon (*B*) and a man.
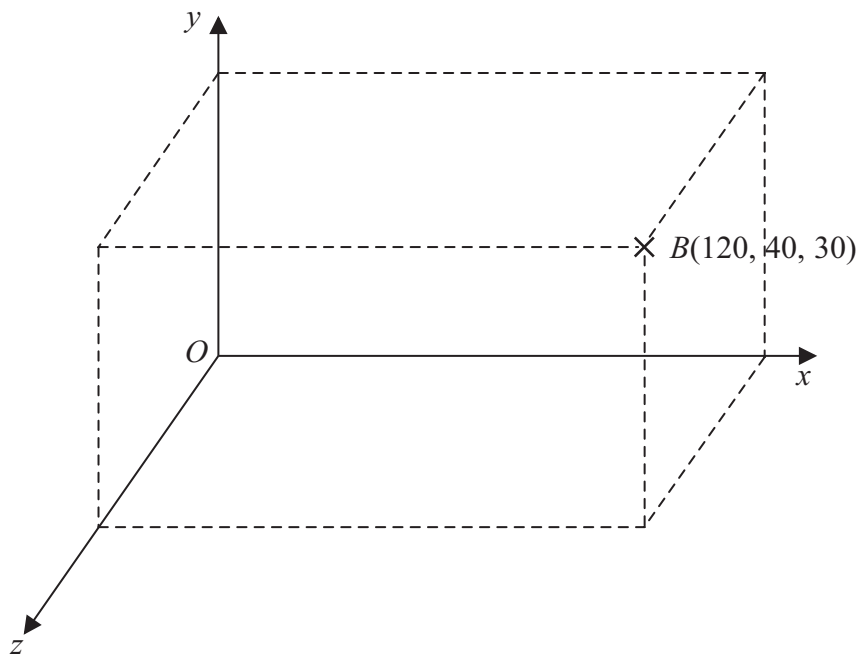The man is standing at the point *O*.

Diagram **NOT**
accurately drawn

The point *O* has coordinates (0, 0, 0).
The point *B* has coordinates (120, 40, 30).

Work out the shortest distance of the hot air balloon from the man.

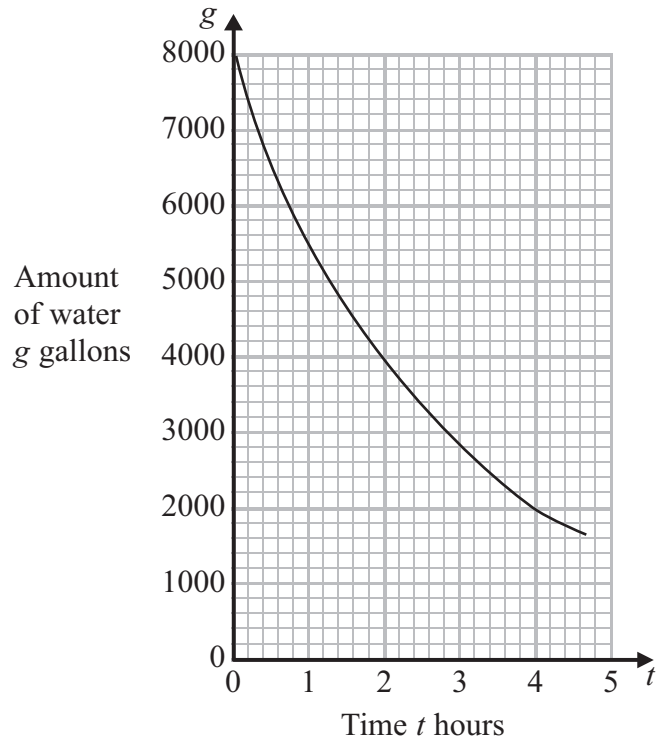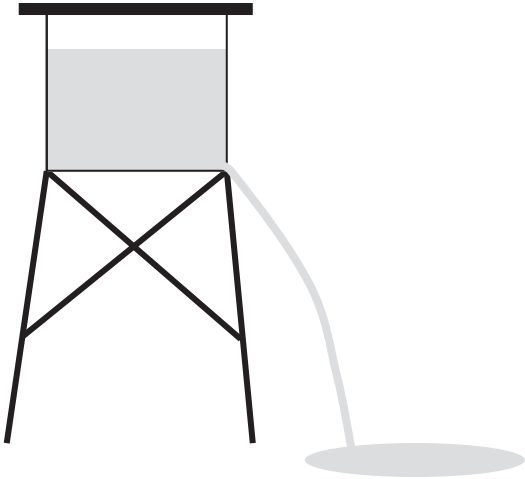.. m

(Total for Question 15 is 4 marks)

16 The diagram shows a tank of water.
Water is leaking out of the bottom of the tank.

The graph shows the amount of water, g gallons, in the tank at time, t hours.

There are 8000 gallons of water in a full tank.

(a) Estimate the amount of water that leaked out of the tank in the first hour.

.... gallons

(1)

(b) After how many hours was the tank half full?

.... hours

(1)

The number of gallons of water in the tank at time, t hours, is modelled by the formula

$$g = ka^{-t}$$

where k and a are positive constants.

(c) Work out the value of k and the value of a.

$k =$ .... $a =$ ....

(4)

(Total for Question 16 is 6 marks)

17 Finlay has 16 model racing cars.

7 racing cars are red,
5 racing cars are green,
4 racing cars are yellow.

Finlay takes at random one of the racing cars.
Jack then takes at random one of the remaining cars.

Work out the probability that Finlay and Jack take different coloured cars.

....

(Total for Question 17 is 5 marks)

18 The time period, T, of a simple pendulum is directly proportional to the square root of the length, d, of the pendulum.

When $d = 2.25$
$\quad\quad\quad T = 3$

(a) (i) Find a formula for T in terms of d.

....

(ii) Work out the value of T when $d = 5.76$

$T = $ ....
(4)

(b) Work out the value of d when $T = 1.2$

$d = $ ....
(2)

(Total for Question 18 is 6 marks)

19 Gina wants to find the height, h metres, of a pylon.
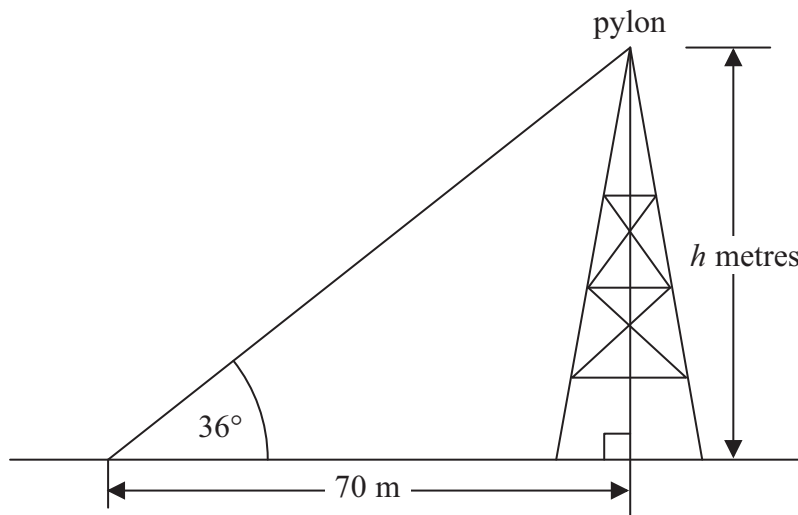

Diagram **NOT** accurately drawn

Gina measures the angle of elevation of the top of the pylon to be 36°, to the nearest 2 degrees.
She measures the horizontal distance from the foot of the pylon to be 70 m, to the nearest metre.

(i) Work out the upper bound and the lower bound for the height of the pylon.
Give your answers correct to 3 significant figures.

Upper bound = ... m

Lower bound = ... m

(ii) Write down the height of the pylon to an appropriate degree of accuracy.
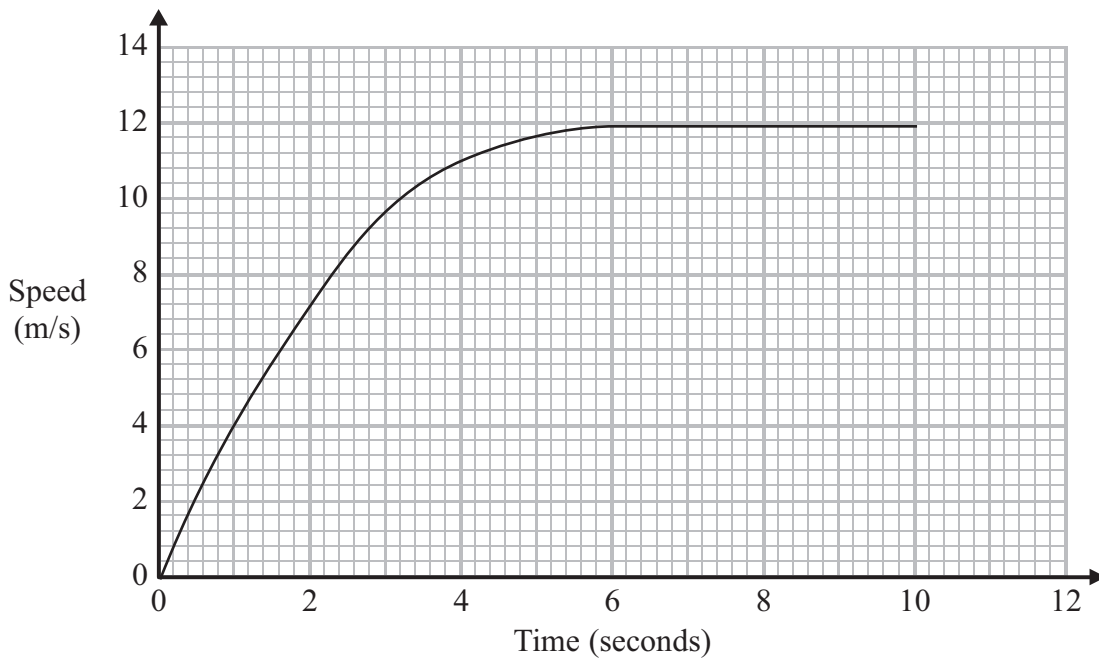
.... m

(Total for Question 19 is 6 marks)

20 An athlete is running in a race.

The diagram shows a speed-time graph for the athlete.

(a) Work out an estimate for the acceleration of this athlete at 3 seconds.

.... m/s^2

(3)

The athlete ran the race in 10 seconds.

The area under the graph gives the distance the athlete ran in the 10 seconds.

*(b) Show that this race could have been a 100 metre race.

(3)

(Total for Question 20 is 6 marks)

TOTAL FOR PAPER IS 100 MARKS