Candidate Name	Centre Number					Candidate Number				
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GCSE

MATHEMATICS - NUMERACY

UNIT 1: NON-CALCULATOR
HIGHER TIER

SPECIMEN PAPER SUMMER 2017

1 HOUR 45 MINUTES

ADDITIONAL MATERIALS
The use of a calculator is not permitted in this examination.
A ruler, protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES
Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided in this booklet.

Take π as 3·14.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

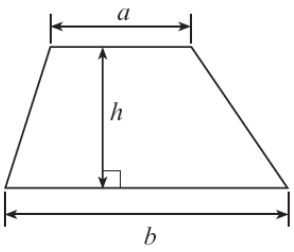
The number of marks is given in brackets at the end of each question or part-question.

The assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing in question **7***(a)*.

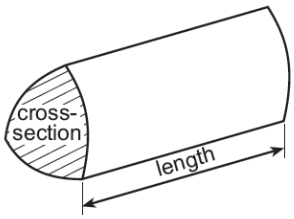
For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**14**	
3.	**6**	
4.	**4**	
5.	**3**	
6.	**5**	
7.	**9**	
8.	**7**	
9.	**8**	
10.	**4**	
11.	**13**	
TOTAL	**80**	

Formula list – Higher tier

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

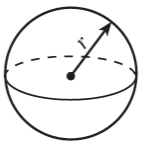


Volume of a prism = area of cross section × length



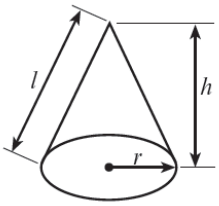
Volume of a sphere $= \frac{4}{3}\pi r^3$

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



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

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

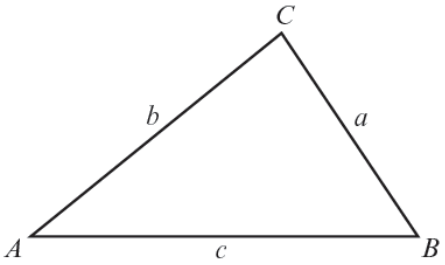


In any triangle *ABC*,

Sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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



The Quadratic Equation

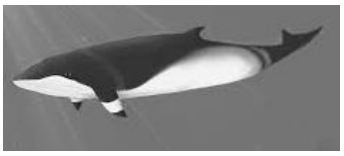
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Annual Equivalent Rate (AER)

AER, as a decimal, is calculated using the formula $\left(1 + \frac{i}{n}\right)^n - 1$, where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.

1. A magazine article states:

Each year one third of the world's whale population migrates around the North West coast of Scotland.



A Minke whale is sighted by a number of people in a sea area near North Minch.

In attempting to locate the Minke whale, the following details are known.

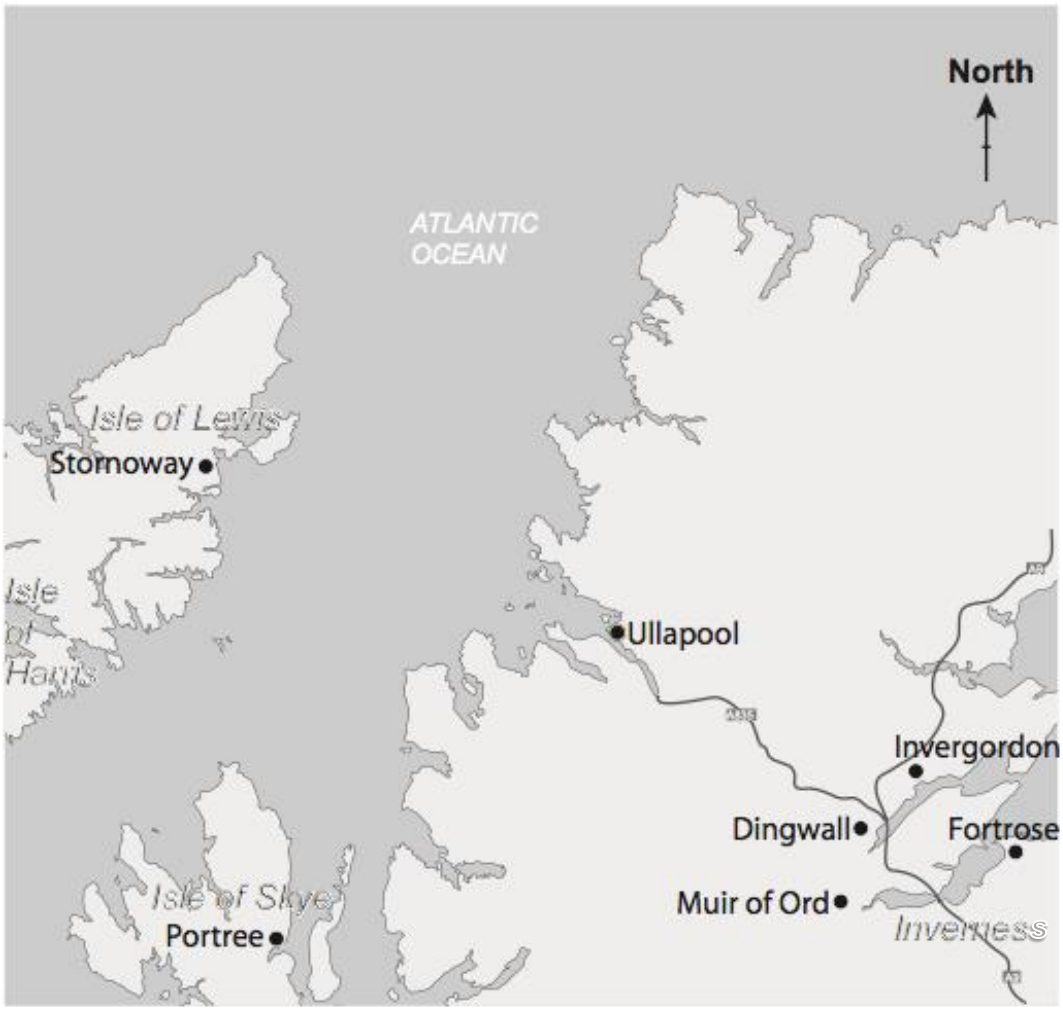
- The distance from Muir of Ord to Dingwall is 10 miles.
- The whale is
  - equidistant from Stornoway and Ullapool,
  - within 30 miles of Portree,
  - further than 10 miles off shore.

(a) Use the map on the next page to indicate possible locations of the sighting of the Minke whale.
You must show all your constructions and working. [5]

(b) Complete the following sentence to give the range of possible bearings of the Minke whale from Stornoway. [2]

The bearing of the Minke whale from Stornaway is between

…… ° and …… °.


North
ATLANTIC
OCEAN
Isle of Lewis
Stornoway
Ullapool
Invergordon
Dingwall
Fortrose
Muir of Ord
Inverness
Isle of Skye
Portree

2. The *Hafod Hotel* swimming pool is currently in need of improvement.

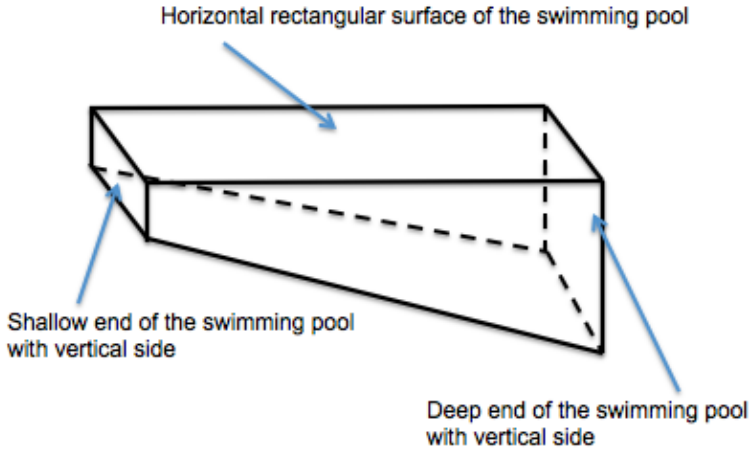


Diagram not drawn to scale

(a) The pool is 1 metre deep at the shallow end, dropping to 3 metres deep at the other end.
The width of the pool is 10 metres and the length is 20 metres.
The length of the sloping floor of the pool is 20·1 metres.

The four walls and the floor within the pool are to be covered in tiles.
This will cost £20 per m^2.

The labour cost of fixing the tiles is £150 per day.
It should take 6 days to tile the pool.

Calculate how much it will cost the hotel to tile the swimming pool. [8]

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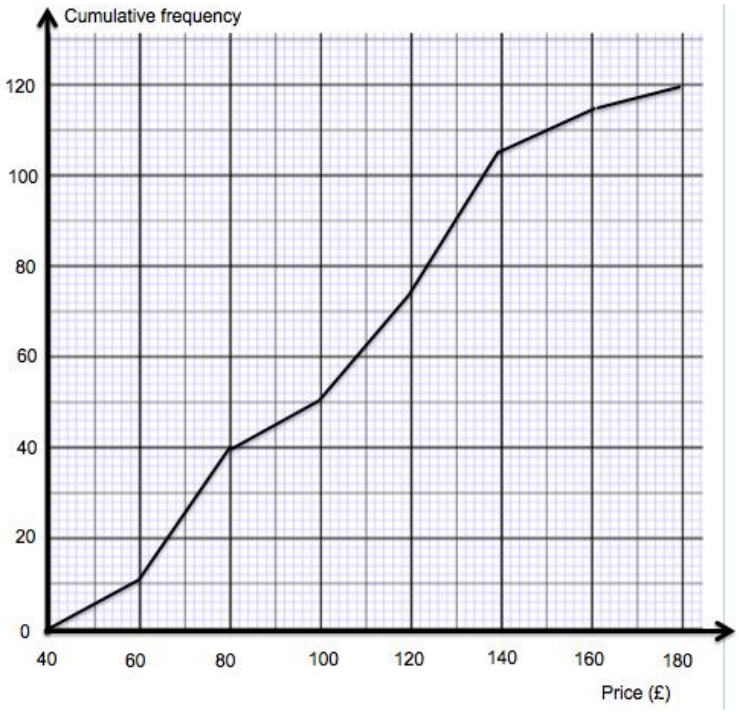
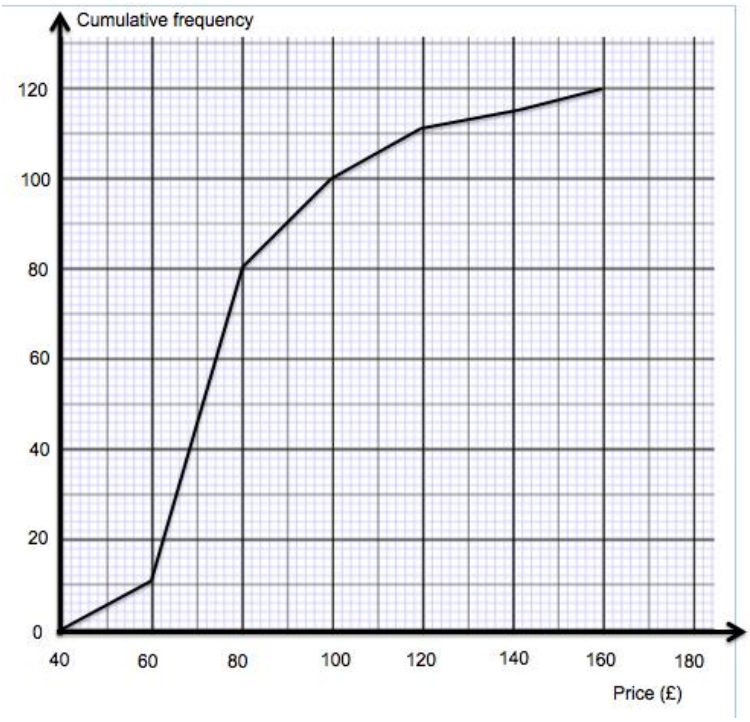
(b) Before agreeing to improve the hotel's swimming pool, the manager of the *Hafod Hotel* decides to check the price of a double room for a night, in hotels with and without swimming pools.

She has grouped her results, 120 hotels with a swimming pool and 120 hotels without a swimming pool.

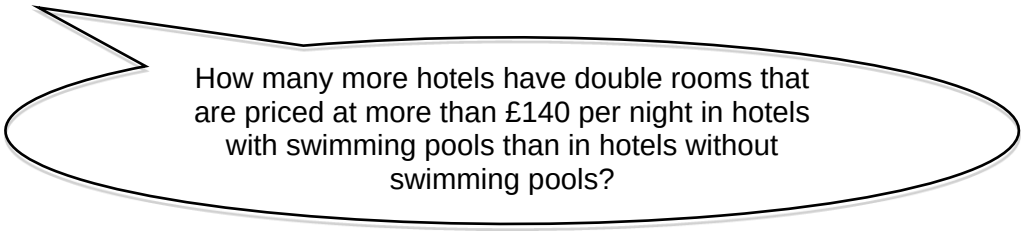
Prices for double rooms at hotels with a swimming pool



Prices for double rooms at hotels without a swimming pool



(i) The *Hafod Hotel* owners look at the manager's findings and ask:



What response should the manager give?
You must show all your working. [2]

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(ii) To help decide whether or not to improve the *Hafod Hotel's* swimming pool, the manager's findings need to be interpreted.

Describe the difference in the distribution of prices for a double room in hotels with a swimming pool compared with those without a swimming pool.

You must use an appropriate average and measure of spread and interpret your findings. [4]

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3. The Royal Mint in Llantrisant in South Wales is the body permitted to manufacture the coins of the United Kingdom.

(a) In March 2013, the Royal Mint estimated the number of coins in circulation.

Coin	Number of coins in circulation (in millions)
£2	394
£1	1526
50p	920
20p	2704
10p	1598
5p	3813
2p	6600
1p	11 293

One particular coin is selected.
The total **value** of the coins in circulation of this selected coin was greater than for any other coin.
Which coin was selected?
Circle your answer. [1]

£2 coin £1 coin 50p coin 10p coin 1p coin

(b) Hari has a gold coin.
It weighs 8g.
What does this weigh in kg?
Circle your answer. [1]

8×10^{3} kg 8×10^{-2} kg 8×10^{-3} kg 8^{-2} kg 8^{-3} kg

(c) How many of these coins could the Royal Mint possibly make from a gold bar weighing 2460g?
Circle your answer. [1]

30 307 310 308 3075

(d) Another gold bar has a mass of 3·86 kg and a volume of 200 cm^3.

Calculate the density, in g/cm^3, of the gold in the bar. [3]

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4. In a factory, Machine A is three times as quick as Machine B in assembling identical circuit boards.
Machine A is allocated two and a half times as many of these circuit boards to assemble as Machine B.

Machine B took 4 hours to assemble all of its allocation.

How long did it take for Machine A to complete its allocation?
Give your answer in hours and minutes. [4]

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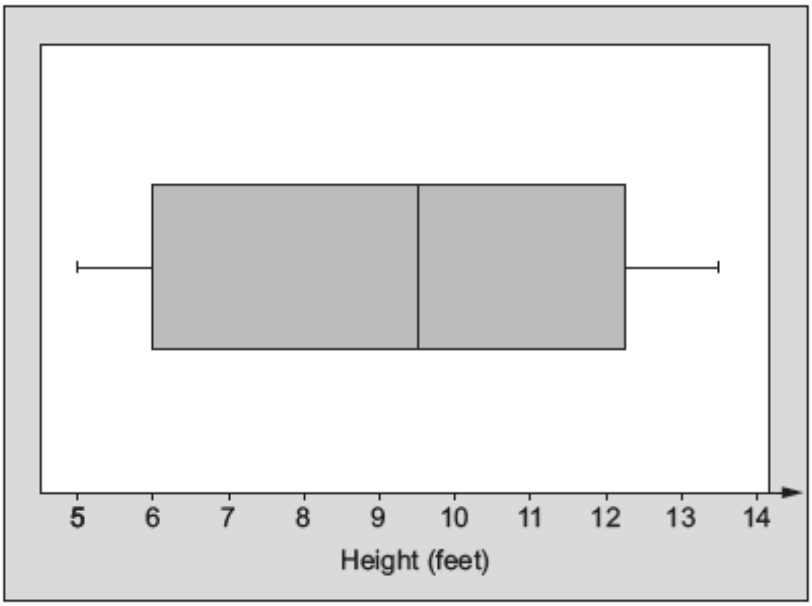
5. The box-and-whisker plot shows information about the height, in feet, of waves measured at a beach on a particular day.



(a) About what fraction of the waves measured were less than 6 feet? [1]

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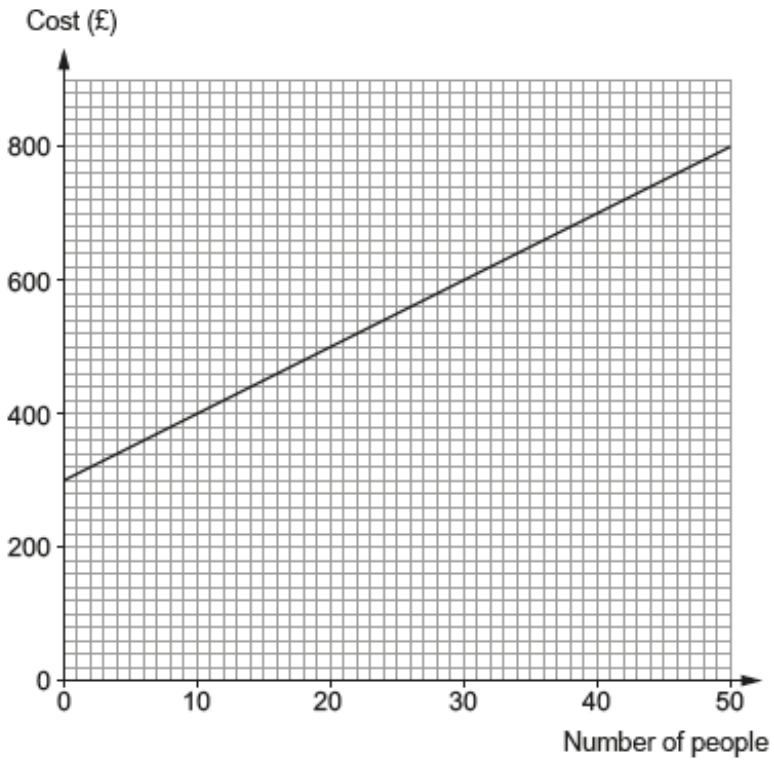
(b) Circle either TRUE or FALSE for each of the following statements. [2]

The smallest wave measured was 5 feet.	TRUE	FALSE
The range of the heights of the waves measured was 6·5 feet.	TRUE	FALSE
Approximately a half of the waves measured were more than 9·5 feet.	TRUE	FALSE
Approximately a quarter of the waves measured were between 6 feet and 9·5 feet.	TRUE	FALSE
The biggest wave measured was 12·25 feet.	TRUE	FALSE

6. Ffion has organised a conference in the *Hafod Hotel*.
The hotel has given Ffion a graph to illustrate the costs for room hire with refreshments for different numbers of people.



(a) (i) Calculate the gradient of the straight line graph. [2]

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(ii) Explain what the gradient tells you about the conference costs. [1]

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(iii) The straight line graph intersects the vertical axis at £300.
Explain what this tells you about the conference costs. [1]

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(b) 20 more people arrived at the conference than Ffion had expected.
The hotel prepared extra food and set out more chairs in the conference room.
Calculate how much **extra** Ffion has to pay the hotel. [1]

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7. *(a)* *You will be assessed on the quality of your organisation, communication and accuracy in writing in this part of the question.*

A company uses its logo in every part of its business.
The smallest version, used on letterheads, has a perimeter of 9 cm and an area of 5 cm^2.
The largest similar version, used on their delivery vans, has a perimeter of 2·7 metres.

Painting the logo on the delivery vans costs £200 per m^2.

How much it would cost to paint one logo on the side of a van?
You must show all your working. [7]

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(b) Rhodri uses formulae to calculate the perimeters and areas of the logos.

In the formulae, a, b, c and d are all lengths.

(i) Which **one** of the following formulae might be used to calculate the perimeter of the logo?
Circle your answer. [1]

Perimeter = $a(b + 2c + d)$

Perimeter = $a - 5b + 2c - d$

Perimeter = $ab + 2c + d$

Perimeter = $a + b + 2c + d^2$

(ii) Which **one** of the following formulae might be used to calculate the area of the logo?
Circle your answer. [1]

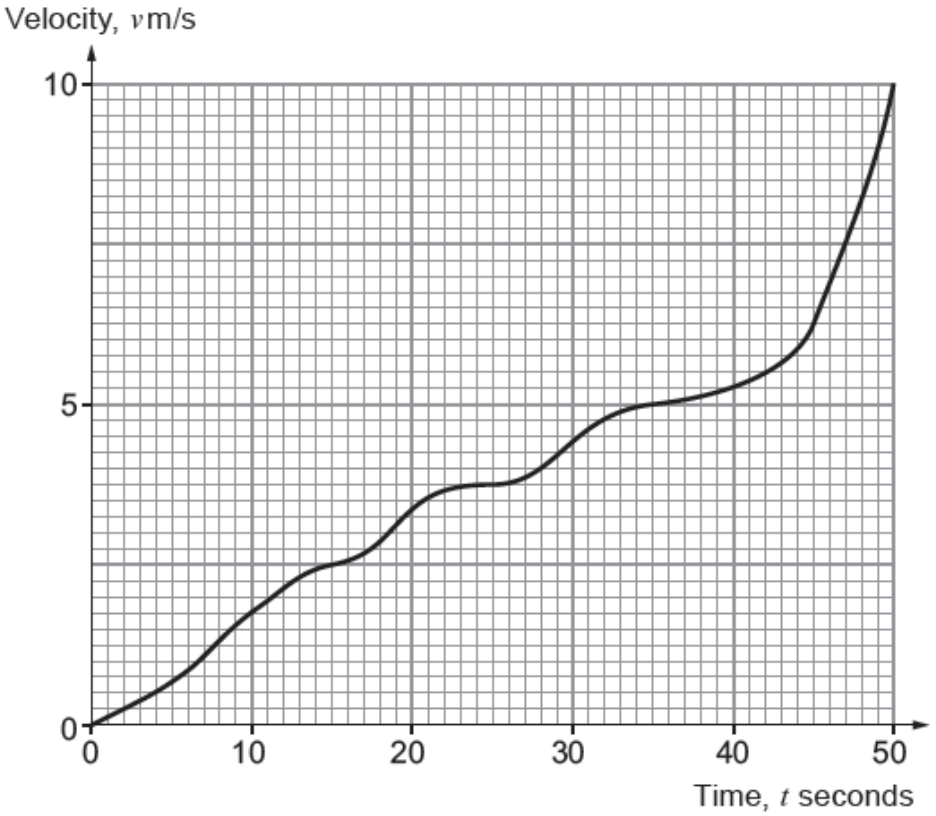
Area = $ad(b + 2c^2)$

Area = $a(5b + 2c + d^2)$

Area = $3(a + b + 2c) + d$

Area = $a(5b + 2c - d)$

8. A velocity-time graph, representing a 50-second journey of a bicycle accelerating from 0 m/s, is shown below.



(a) Calculate an estimate for the acceleration at time t = 30 seconds.
You must give the units for your answer. [4]

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Acceleration: ……

(b) Calculate an estimate for the distance travelled by the bicycle in the first 30 seconds. [3]

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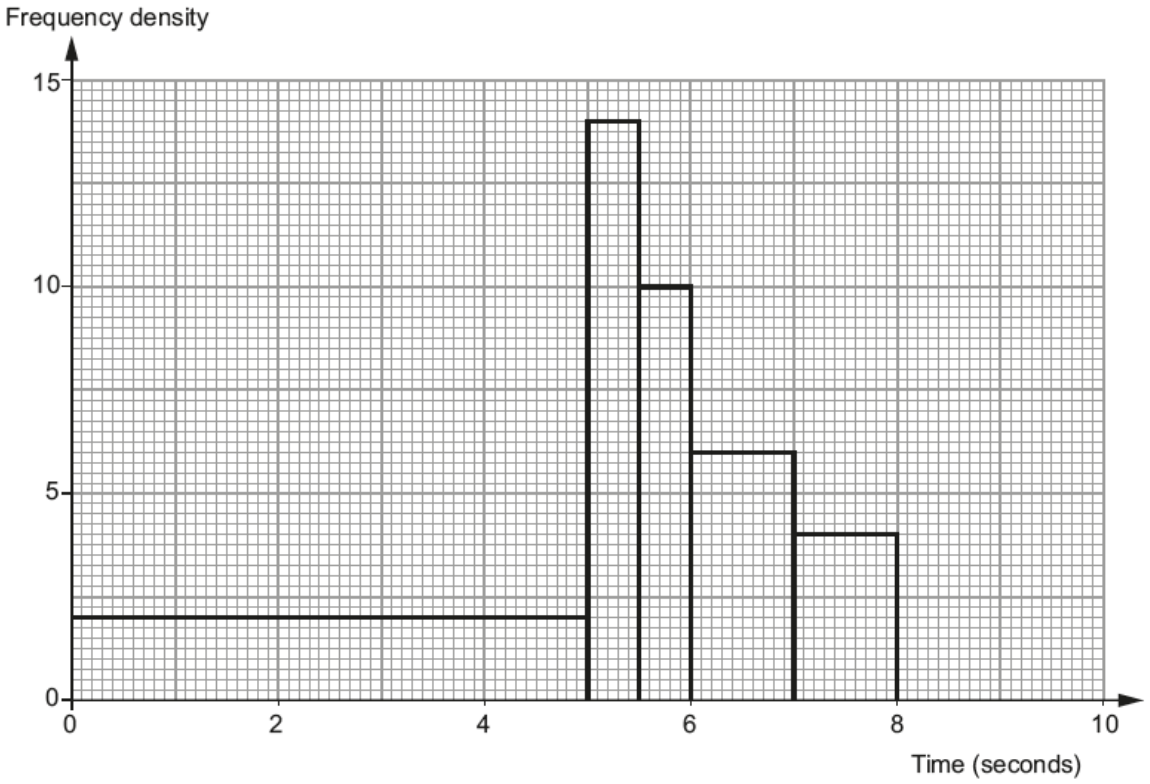
Distance travelled: …….

9. Dewi records the times a group of pupils take to type a particular message into their mobile phones.

Dewi began to draw a histogram to shows the results.



(a) Two pupils took between 8 seconds and 10 seconds to type the message.
Use this information to complete Dewi's histogram.
You must show all your working. [2]

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(b) Circle either TRUE or FALSE for each of the following statements. [2]

2 pupils took less than 5 seconds to type the message.	TRUE	FALSE
2 more pupils took between 6 and 7 seconds to type the message than took between 7 and 8 seconds.	TRUE	FALSE
Somebody definitely typed the message in less than 1 second.	TRUE	FALSE
Somebody definitely typed the message in more than 9 seconds.	TRUE	FALSE
Most pupils typed the message between 5 and 5·5 seconds.	TRUE	FALSE

(c) Dewi says:

"I think more than 60% of the pupils took between 5 seconds and 7 seconds to type the message."

By calculating how many pupils typed the message, decide whether Dewi is correct or not.
You must show all your working. [4]

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10. A shopkeeper pays £120 for an mp3 player.
He wishes to put a marked price on the mp3 player so that, in the forthcoming sale, when he gives a discount of 25% on the marked price, he will still make a profit of 20% on the price paid for the mp3 player.
Find the marked price. [4]

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11. *(a)* In 2009, approximate costs for building 1 mile of road in Wales were published, as given below.

Type of road	Approximate cost per mile
Single carriageway	£8 million
Dual carriageway	£13 million
Motorway	£24 million

A road was built in 2009 that went 10% over the published costs.

This road is 28 miles long, with $\frac{3}{4}$ of its length being a single carriageway and the remainder being a dual carriageway.

(i) Calculate an estimate of the cost of building the single carriageway. [3]

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(ii) Calculate an estimate of the cost of building the remaining dual carriageway.
Circle your answer. [1]

£10 million £10^6 £9×10^7 £1×10^8 £14.3 million

(b) Most motorways in the UK are free to use.
The cost of building motorways has increased.
A toll motorway means that drivers have to pay to drive their vehicle on it.
The toll payments help recover the building costs.

Built between	Motorway	Approximate length	Approximate total build cost
1960 and 1976	M62	100 miles	£$7{\cdot}7 \times 10^8$
1975 and 1985	M25	120 miles	£$9{\cdot}2 \times 10^8$
2000 and 2003	M6 toll	30 miles	£$9{\cdot}0 \times 10^8$

Use the information in the table above to answer the following questions.

(i) Was there an increase in the cost of building **one mile** of motorway between the time when the M62 was built and the time when the M25 was built?
You must show all your working to justify your answer. [4]

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(ii) When the M6 toll motorway was opened, in 2003, it cost £2 for a car and £10 for a lorry to use.
By 2012, the cost for a car had increased to £5.50 and the cost for a lorry had increased to £11.

You may assume that:

- approximately 39 000 vehicles use the M6 toll motorway each day
- there were 1000 more cars than lorries using the motorway each day.

By making relevant approximations, estimate how many years of toll fees it will take to recover the cost of building the M6 toll motorway.
You must show all your working and state any further assumptions that you make.

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