Surname	Centre Number	Candidate Number
Other Names		0

WJEC CBAC

GCSE

4370/05

SOLUTIONS .

MATHEMATICS – LINEAR
PAPER 1
HIGHER TIER

A.M. TUESDAY, 11 June 2013

2 hours

CALCULATORS ARE NOT TO BE USED FOR THIS PAPER

ADDITIONAL MATERIALS

A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

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.

If you run out of space, use the continuation page at the back of the booklet, taking care to number the question(s) correctly.

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.

You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question **5**.

For Examiner's use only

Question	Maximum Mark	Mark Awarded
1	3	
2	7	
3	5	
4	3	
5	9	
6	5	
7	3	
8	7	
9	5	
10	6	
11	5	
12	9	
13	3	
14	8	
15	6	
16	4	
17	12	
TOTAL MARK		

4370
050001

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CJ*(S13-4370-05)

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1.

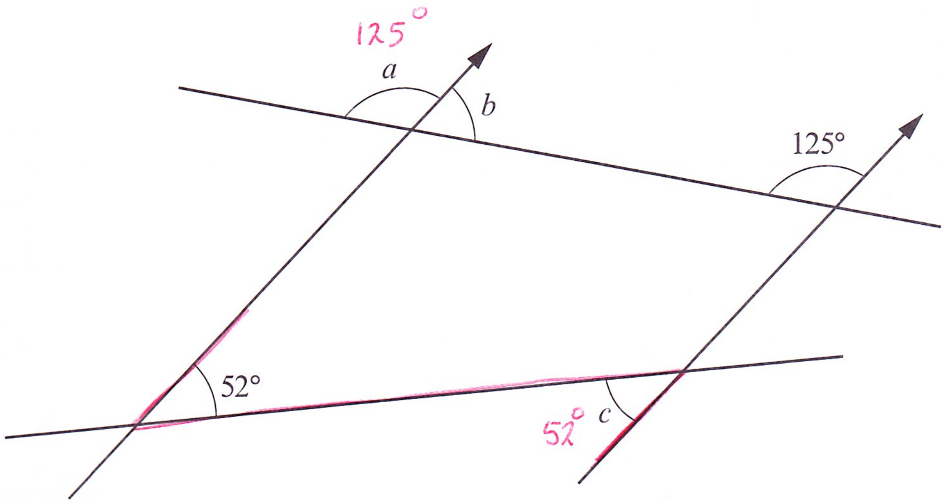


Diagram not drawn to scale

Find the size of each of the angles a, b and c.

$a =$ 125° ° $b =$ 55° ° $c =$ 52° °

[3]

180 − 125
= 55°

4370
050003

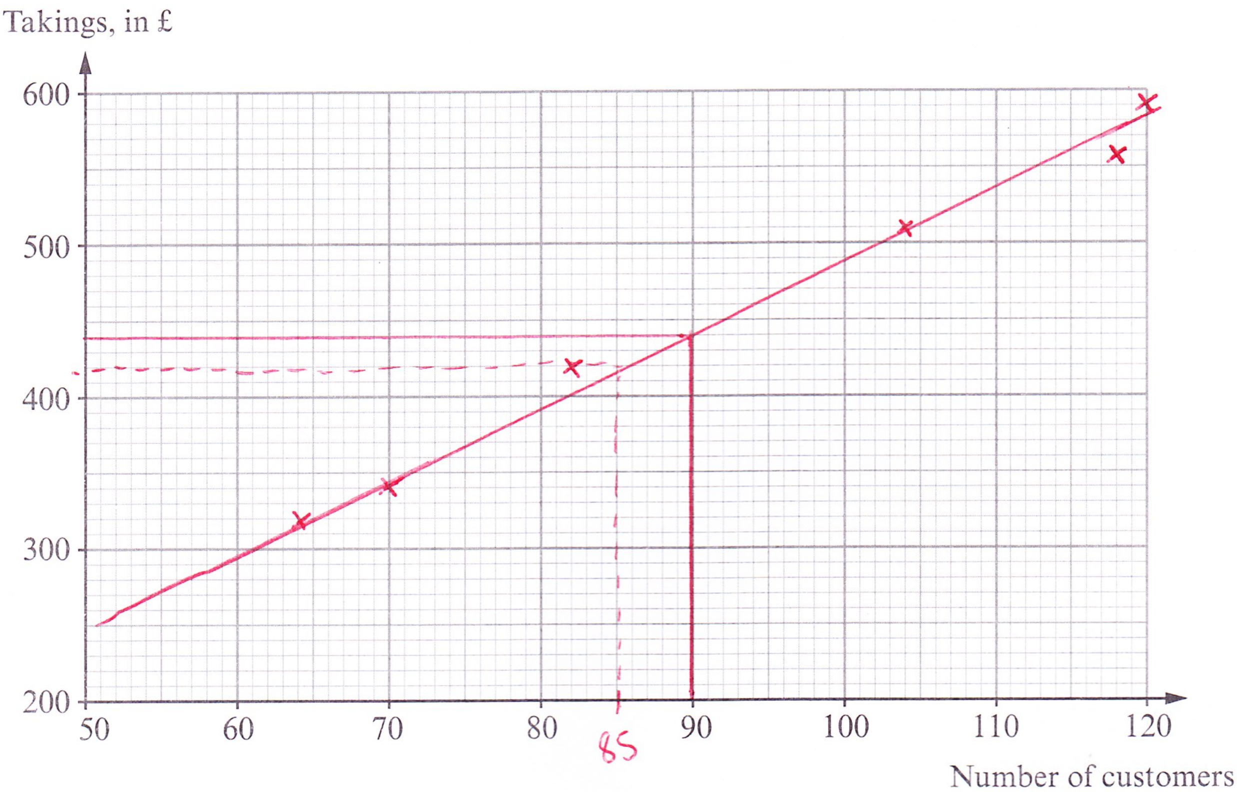
Turn over.

Examiner only

2. Every Friday for 6 weeks, the number of customers entering a sandwich shop and the takings of the shop were recorded.
The takings were recorded correct to the nearest £10.
The table below shows the results.

Number of customers	104	82	120	64	70	118
Takings, in £	510	420	590	320	340	560

(a) On the graph paper below, draw a scatter diagram of these results.



[2]

(b) Write down the type of correlation that is shown by the scatter diagram.

POSITIVE

[1]

(c) Draw, by eye, a line of best fit on your scatter diagram. [1]

(d) Estimate the takings for a Friday when there are 90 customers.

£440

[1]

Examiner only

(e) Approximately how much does a customer spend, on average, in the sandwich shop on a Friday?

From 50 - 120 = 70 So 70 ÷ 2 = 35 ⇒ 50 + 35 = 85

∴ 85'th customer on graph ≈ £420

[2]

∴ 420 ÷ 85

≈ £4·90 average.

4370 050005

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3. Two types of banana are available to buy, Fairtrade and non-Fairtrade.
Each type of banana costs 30p.
The table below shows how the 30p is shared for each type of banana.

	Non-Fairtrade	Fairtrade
Grower	2p	15p
Plantation owner	5p	2p
Wholesale importer	3p	2p
Shipper	4p	3p
Ripener	4p	2p
Seller	12p	6p
Total	30p	30p

(a) Calculate the percentage of the cost of a banana that goes to the seller under

(i) non-Fairtrade,

$\frac{12}{30} \overset{\div 3}{=} \frac{4}{10} \overset{\times 10}{=} \frac{40}{100} = 40\%$

[2]

(ii) Fairtrade.

$\frac{6}{30} \overset{\div 3}{=} \frac{2}{10} \overset{\times 10}{=} \frac{20}{100} = 20\%$

[1]

Examiner only

(b) A newspaper report states that the Grower gets too small a proportion of the price of a non-Fairtrade banana. Explain, using fractions, how this has improved with the move to producing Fairtrade bananas.

Non Fairtrade : grower gets $\frac{2}{30} = \frac{1}{15}$ of 30p

Fairtrade : grower gets $\frac{15}{30} = \frac{1}{2}$ of 30p.

[2]

4370

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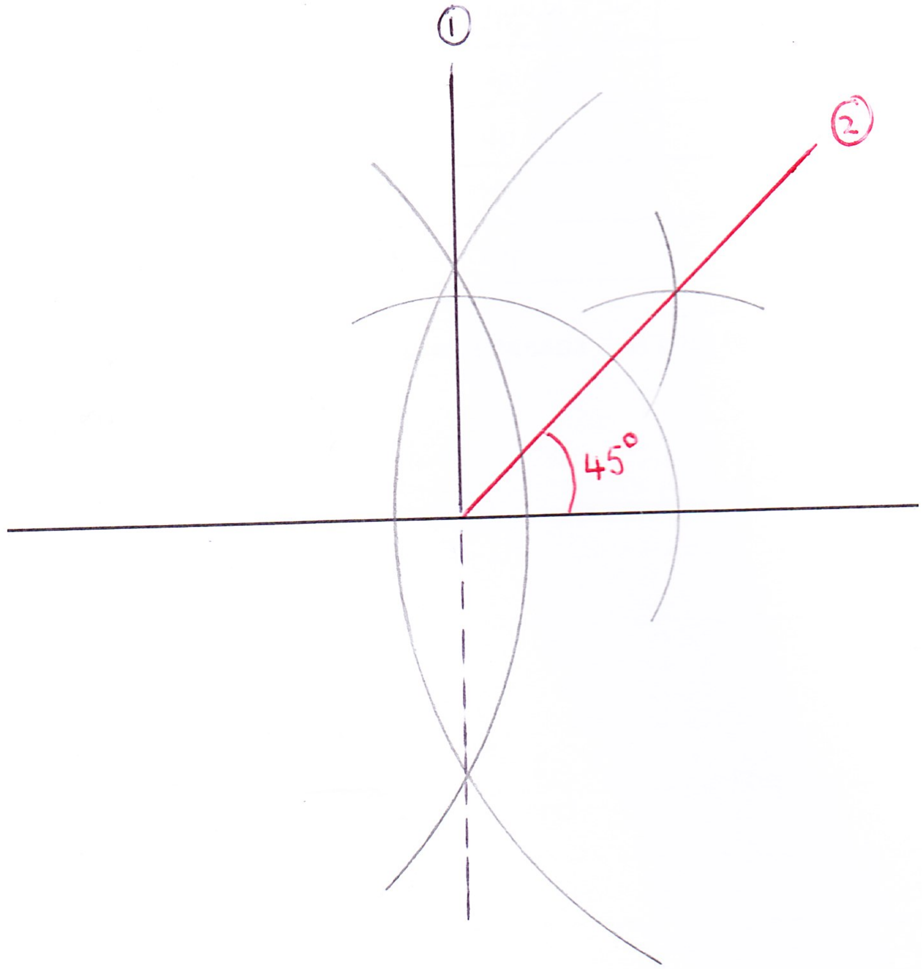
4. In answering this question, you must show all your construction arcs.
Use a ruler and a pair of compasses to construct an angle of 45° at the mid-point of the straight line below.
Label your angle 45°.

(1) Draw perpendicular bisector. This is 90° angle at the midpoint.
(2) Bisect the 90° angle to get 45° at mid-point.



[3]

Examiner only

5. *You will be assessed on the quality of your written communication in this question.*

Pedro has just moved to live on an island in Europe.
There is a choice of two different water companies.

Manana Water	Channel Water
No Standing Charge	Standing Charge: €30 every 3 months + €0.02 per m^3 of water used
Pay €0.06 per m^3 of water used	*Special offer*: 20% off your **first** bill

Pedro estimates that he uses 700 m^3 of water every three months.
He wants to spend as little as possible on water.
Which company should Pedro buy his water from?
You must justify your answer by showing all possible costs.

Manana

Cost = 700 x 0·06
= 7 x 100 x 0·06
= 7 x 6
= €42

Channel

Cost = 30 + (700 x 0·02)
= 30 + (7 x 2)
= €44

This means usually it is cheaper with Manana by €2 per 3 month period.

BUT 20% reduction for first bill with Channel

Reduction = $\underbrace{44 \div 10}_{\text{gives } 10\%} \underbrace{\times\ 2}_{\text{gives } 20\%}$

= €8·80

∴ 1st bill with Channel is only 44 − 8·80 = €35·20

€2 difference / ~~month~~ 3 months

So for first 3 ~~months~~ BILLS you would have spent less with Channel After that Manana is cheaper to use

[9]

(4370-05)

Turn over.

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050009

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7.

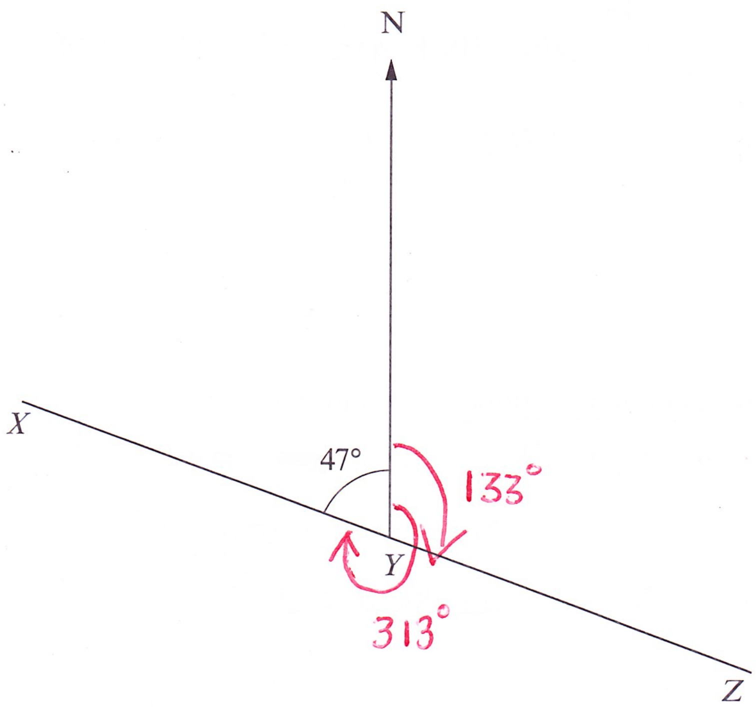


Diagram not drawn to scale

The above diagram shows three points *X*, *Y* and *Z* which lie on a straight line.

Calculate the bearing of

(a) *Z* from *Y*,

$180 - 47 = 133°$

[1]

(b) *X* from *Y*.

$360 - 47 = 313°$

[2]

Examiner only

8. *(a)* Find the highest common factor of 90 and 105.

↓

Biggest number that goes into 90 and 105

105 − 90 = 15

TRY 15 !!

$90 = 15 \times 6 = 90$ $\quad$ $105 = 15 \times 7 = 105$

$\therefore$ 15

[2]

(b) Find the lowest common multiple of 90 and 105.

smallest number that both 90 and 105 go into.

90 x times table: 90, 180, 270, 360, 450, 540, $\boxed{630}$

105 x times table: 105, 210, 315, 420, 525, $\boxed{630}$

$\therefore$ 630

[2]

(c) Express 936 as a product of prime numbers in index form.

$2\,\overline{)\,936}$ = 468

936 → 2, 468

468 → 2, 234

234 → 2, 117

117 → 3, 39

39 → 3, 13

$3\,\overline{)\,117}$ = 39

[3]

$936 = 2^3 \times 3^2 \times 13$

Examiner only

9. A company is making cylinders to package plastic rods.
Each cylinder is made using a rectangular piece of card and two circular pieces of metal.
The net of one of these cylinders is shown below.

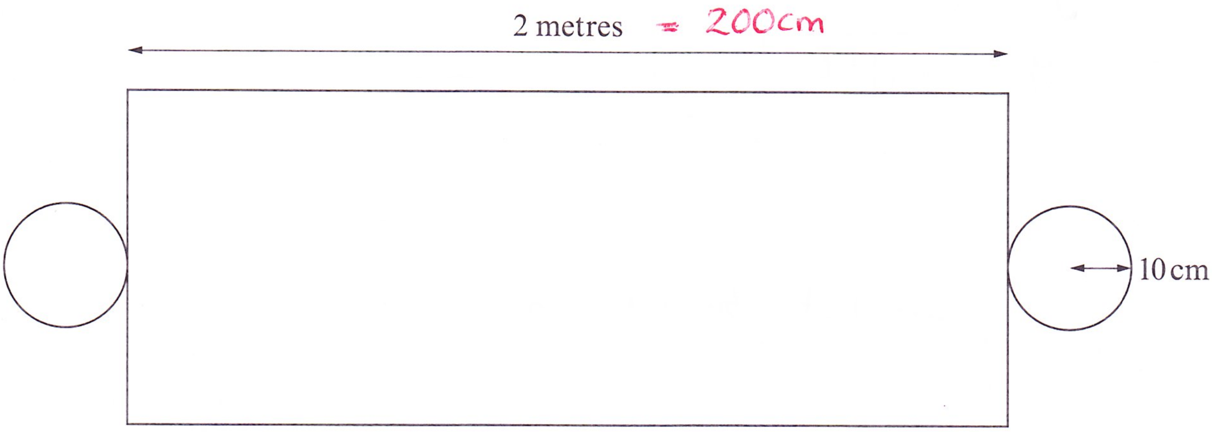


Diagram not drawn to scale

The radius of each circular end is 10 cm.
The cylinder is of length 2 metres.
Taking $\pi = 3{\cdot}14$, calculate the **area of the rectangular piece of card**.
State the units of your answer.

Width of rectangle = circumference of circle

= πD

= $3 \cdot 14 \times 20$

= $62 \cdot 8$ cm

$\therefore$ Area rectangular card cm

= $200 \times 62 \cdot 8$

= $2 \times 100 \times 62 \cdot 8$

= 6280×2

= $6280 \times 2 = 12560$ = $12560\ cm^2$

[5]

Examiner only

10. Rearrange the following formulae to make y the subject.

(a) $y^2 - t = g$

$y^2 = g + t$

$y = \sqrt{g+t}$

[2]

← Put brackets in

(b) $\dfrac{(3y+w)}{(2y+3)} = 5$

$\times\ (2y+3)$

EXPAND

$(3y+w) = 5(2y+3)$

$3y+w = 10y + 15$

$w - 15 = 10y - 3y$

$w - 15 = 7y$

$\dfrac{(w-15)}{7} = y$

[4]

Examiner only

11. The diagrams show how 12 small identical rectangles can be placed to form a larger rectangle in two different ways.

Diagram 1

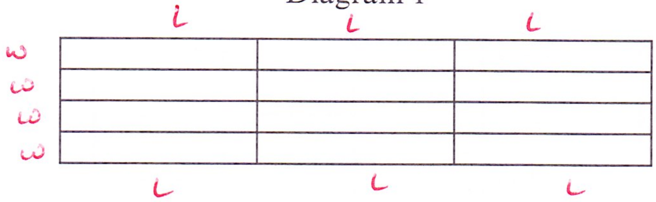
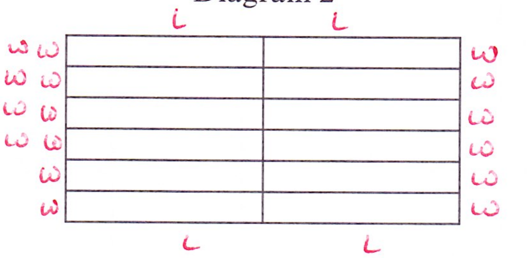


Diagram 2



Diagrams not drawn to scale

The perimeter of each of these diagrams is measured.
The perimeter of diagram 1 is 55 cm.
The perimeter of diagram 2 is 50 cm.

Find the dimensions of one of the 12 small identical rectangles.

Diagram 1 $\qquad\qquad$ Diagram 2

$6l + 8w = 55 \qquad\qquad 4l + 12w = 50$

These are simultaneous equations

$6l + 8w = 55 \quad -① \quad \times 3$

$4l + 12w = 50 \quad -② \quad \times 2$

$18l + 24w = 165$

$-8l \mathbin{\bar{+}} 24w = \bar{\ }100$ ← change sign of bottom line

ADD $\quad 10l = 65$

$l = \frac{65}{10} = 6.5\text{cm}$

From ② $\quad 4(6.5) + 12w = 50$

$26 + 12w = 50$

$12w = 50 - 26$

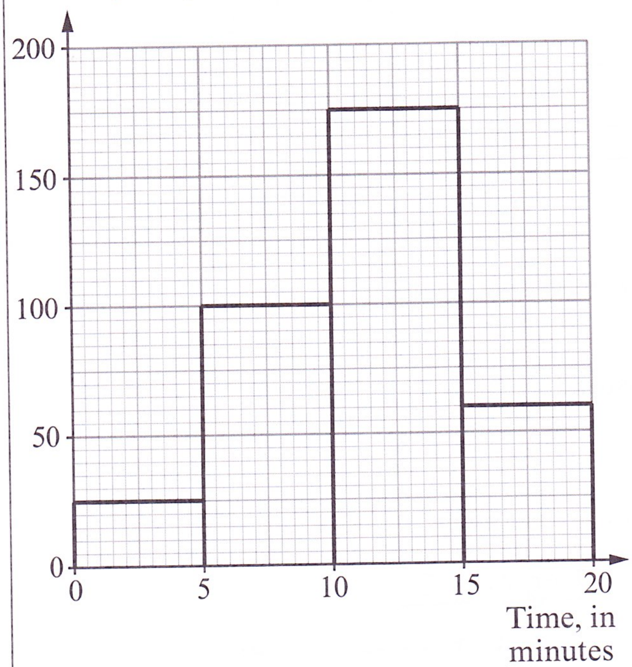
$12w = 24$

$w = 2\text{cm}$

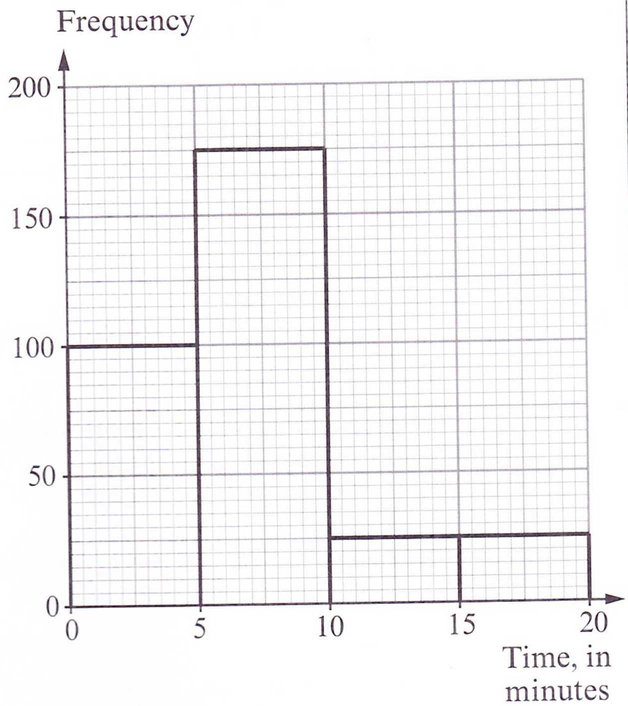
[5]

12. The frequency diagrams show the lengths of telephone calls taken by two online shopping companies one day in November.

Cat Boots UK



Shoes 4 All



(a) How many calls to Cat Boots UK lasted between 5 minutes and 15 minutes?

100 + 175

= 275

[1]

(b) Which company had longer calls on average on this day?
Give a reason for your answer.

Cat Boots UK because the tallest bar is further right on the time scale

[1]

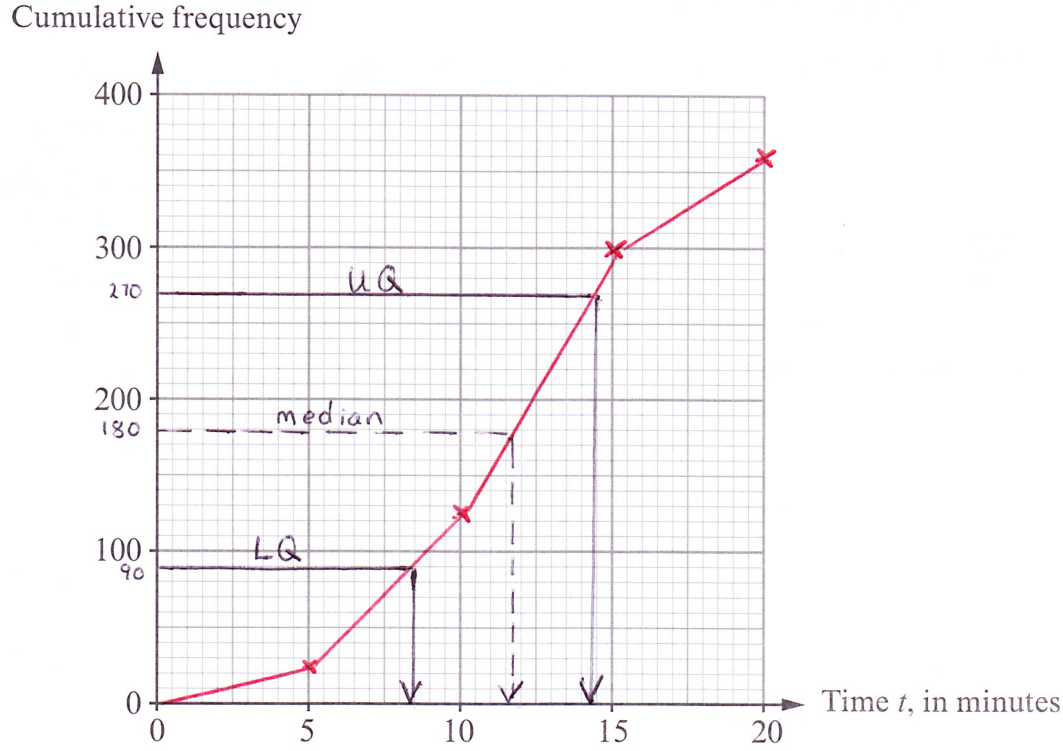
(c) Complete the cumulative frequency table for Cat Boots UK times.

Time t, in minutes	$t \leqslant 5$	$t \leqslant 10$	$t \leqslant 15$	$t \leqslant 20$
Cumulative frequency	25	125	300	360

[2]

Examiner only

(d) Use the graph paper below to draw a cumulative frequency diagram for the Cat Boots UK information.



[2]

(e) Use your cumulative frequency diagram to find

(i) an estimate for the median time of calls to Cat Boots UK,

Median is 180th result approx ≈ 12 mins

[1]

(ii) an estimate for the inter-quartile range of the times for calls to Cat Boots UK.

Lower Quartile is 90'th result ≈ 8·5 mins
(360 ÷ 4)

Upper Quartile is 90×3 = 270'th result ≈ 14·5 mins

[2]

IQR = 14·5 − 8·5
≈ 6 mins

Examiner only

13. A farmer has just enough food to feed x pigs for y days.

(a) Write down an expression for the number of days the farmer could feed z pigs with the same amount of food.

Think using numbers. eg. 3 pigs for 2 days
$\div 3$ 1 pig for $\frac{2}{3}$ day
$\times 5$ 5 pigs for $\frac{2}{3} \times 5$ days.

SO x pigs y days
1 pig for y/x days
z pigs for yz/x days

[2]

(b) Write down an assumption you have made in answering part *(a)*.

All pigs eat the same.

[1]

 (4370-05)

Examiner only

14. *(a)* Express $\dfrac{x}{x-3} - \dfrac{x}{x+6}$ as a single fraction in its simplest form.

$$= \frac{x(x+6) - x(x-3)}{(x-3)(x+6)}$$

$$= \frac{x^2 + 6x - x^2 + 3x}{(x-3)(x+6)}$$

$$= \frac{9x}{(x-3)(x+6)}$$

[3]

(b) Simplify $\dfrac{49x^2 - 100}{14x + 20}$.

Factorise Difference of 2 squares gives $(7x+10)$ on top

$$= \frac{(7x-10)\cancel{(7x+10)}}{2\cancel{(7x+10)}}$$

You can cancel $(7x+10)$

common factor of 2 gives $(7x+10)$ on both

$$= \frac{(7x-10)}{2}$$

OR $3.5x - 5$

[4]

(c) Simplify $\dfrac{(2x-5)^8}{(2x-5)^6}$.

2nd Law of indices subtract powers $8-6$

$\left(\text{eg. } \dfrac{7^8}{7^6} = 7^2 \right)$

$$= (2x-5)^2$$

[1]

Examiner only

15. *(a)* Express $0{\cdot}4\dot{3}\dot{5}$ as a fraction.

Let $x = 0{\cdot}4\dot{3}\dot{5}$

$10x = 4{\cdot}\dot{3}\dot{5}$ — ①

$1000x = 435{\cdot}\dot{3}\dot{5}$ — ②

You need to get the decimals to be identical so when you subtract them they cancel each other out.

SUBTRACT ① from ②

$990x = 431$

$x = \frac{431}{990}$

[2]

(b) Express $100^{-\frac{1}{2}}$ as a fraction.

$= \frac{1}{100^{1/2}} = \frac{1}{\sqrt{100}} = \frac{1}{10}$

[1]

(c) Given that $f = \sqrt{2}$, $g = \sqrt{5}$ and $h = \sqrt{10}$, find, in its simplest form,

(i) $\frac{fg}{h}$,

$\frac{\sqrt{2}\sqrt{5}}{\sqrt{10}} = \frac{\sqrt{2 \times 5}}{\sqrt{10}} = \frac{\sqrt{10}}{\sqrt{10}} = 1$

[1]

(ii) $fg + h$,

$\sqrt{2}\sqrt{5} + \sqrt{10}$

$= \sqrt{10} + \sqrt{10}$

$= 2\sqrt{10}$

[1]

(iii) fh.

$\sqrt{2}\sqrt{10}$

$= \sqrt{20}$

$= \sqrt{4 \times 5}$

$= \sqrt{4}\sqrt{5} = 2\sqrt{5}$

[1]

Examiner only

16. The points A and B lie on the circumference of a circle with centre O.
The straight lines PAQ and RBQ are tangents to the circle.

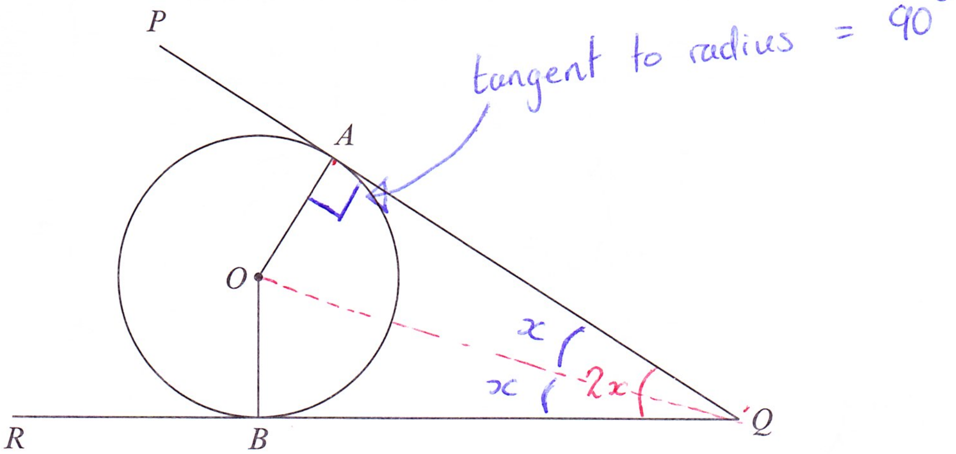


Diagram not drawn to scale

You are given that $A\hat{Q}B = 2x$, where x is measured in degrees.

Write down the size of $A\hat{O}Q$ in terms of x.
Give reasons in your answer.

Angle in triangle AOQ

$A\hat{O}Q = 180 - 90 - x$

$= 90 - x$

[4]

Examiner only

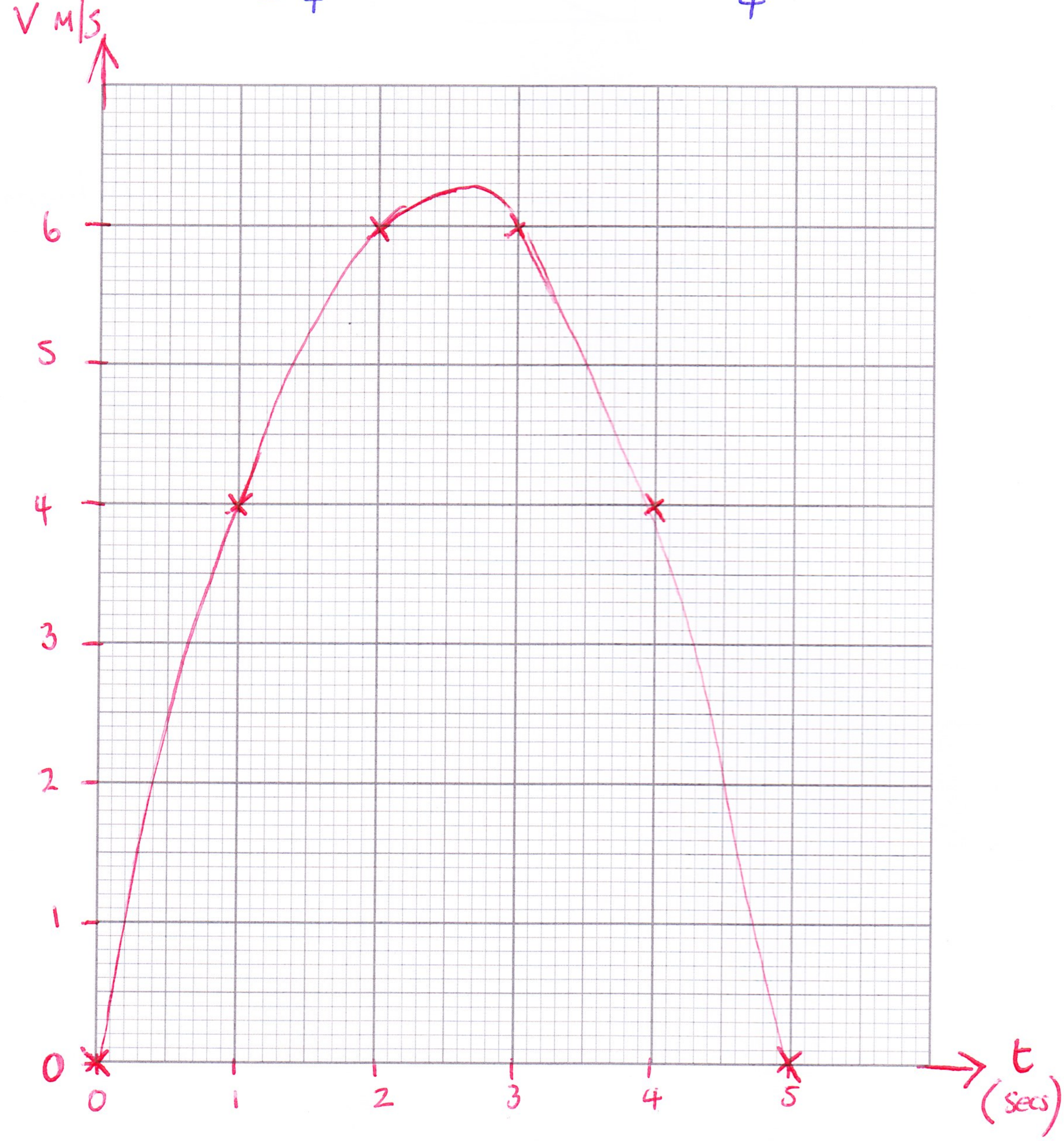
17. *(a)* In an experiment, it was found that the velocity, v m/s, of a particle at time t seconds was given by the equation $v = 5t - t^2$.

Draw the graph of $v = 5t - t^2$ for values of t from 0 to 5.

t	0	1	2	3	4	5
v	0	4	6	6	4	0

$5(1) - 1^2$
$= 5 - 1$
$= 4$

$5(4) - 4^2$
$= 20 - 16$
$= 4$

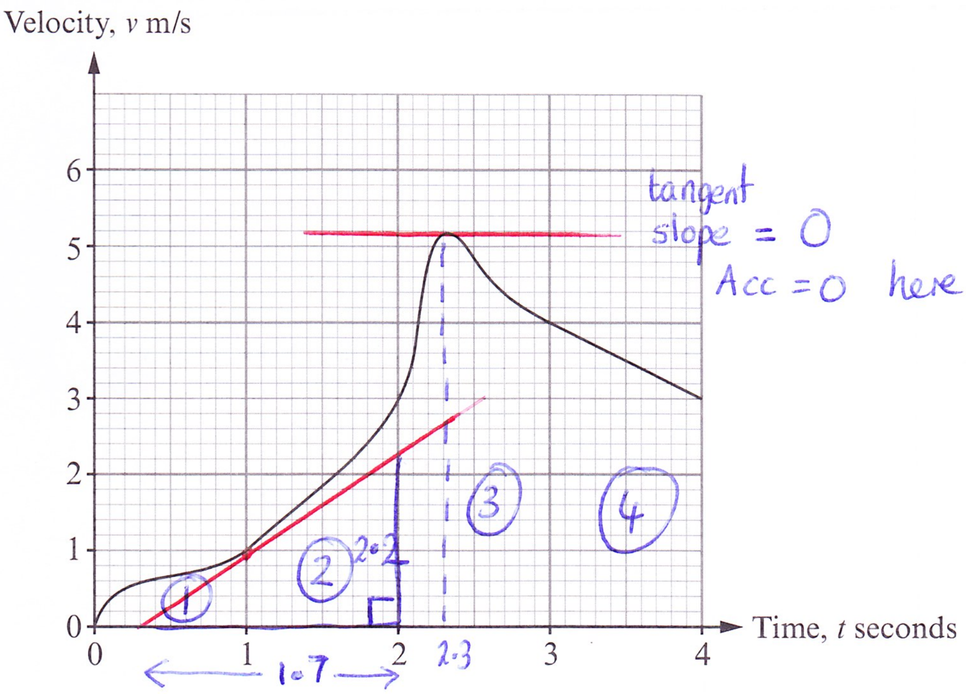


[4]

 (4370-05)

Examiner only

(b) A velocity-time graph for a different experiment is shown below.



(i) Based on this experiment, complete the following sentence. [1]

"The acceleration of this particle is zero when t = 2·3 "

(ii) Find an approximation for the acceleration of the particle in this experiment when $t = 1$. Give the units of your answer. [4]

Draw tangent $t = 1$ Gradient = acc = $\frac{\text{height}}{\text{base}}$

$\approx \frac{2 \cdot 2}{1 \cdot 7}$

$\approx \frac{22}{17}$ m/s^2

(iii) Find an approximation for the distance travelled by the particle between $t = 0$ and $t = 4$. [3]

EASIER if

* Use trapezium (2) from $x = 1$ to $x = 2\cdot3$

* Use trapezium (3) from $x = 2\cdot3$ to $x = 3$

Area under graph (V/T) = distance travelled

= (1) + (2) + (3) + (4)

$= \frac{bh}{2} + \frac{(a+b)h}{2} + \frac{(a+b)h}{2} + \frac{(a+b)h}{2}$

$= \frac{1(1)}{2} + \frac{(1+5)1\cdot3}{2} + \frac{(5+4)0\cdot7}{2} + \frac{(4+3)1}{2}$

$= 0\cdot5 + 3\cdot9 + 3\cdot15 + 3\cdot5$

$\approx$ 11 m travelled.