Surname	Centre Number	Candidate Number
Other Names		0

WJEC CBAC

GCSE

4370/06

SOLUTIONS

MATHEMATICS – LINEAR
PAPER 2
HIGHER TIER

A.M. TUESDAY, 17 June 2014

2 hours

ADDITIONAL MATERIALS

A calculator will be required for this paper.

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 or use the π button on your calculator.

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 **2***(a)*.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	5	
2.	8	
3.	16	
4.	5	
5.	6	
6.	3	
7.	4	
8.	8	
9.	4	
10.	6	
11.	6	
12.	7	
13.	6	
14.	7	
15.	9	
Total	100	

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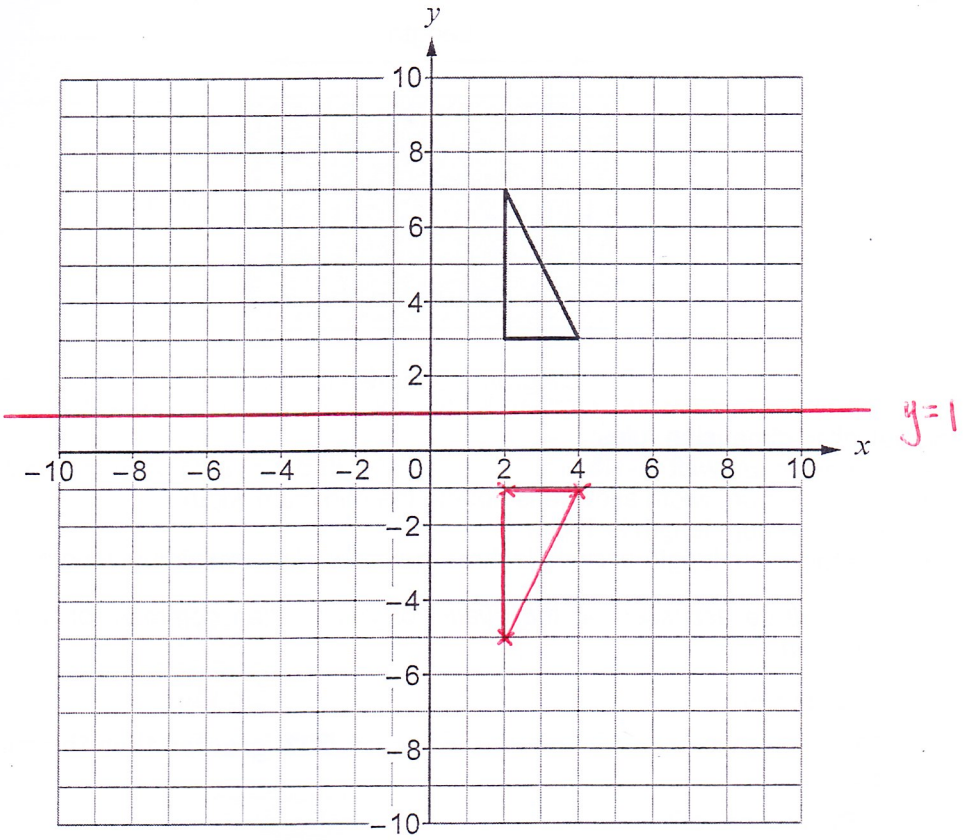
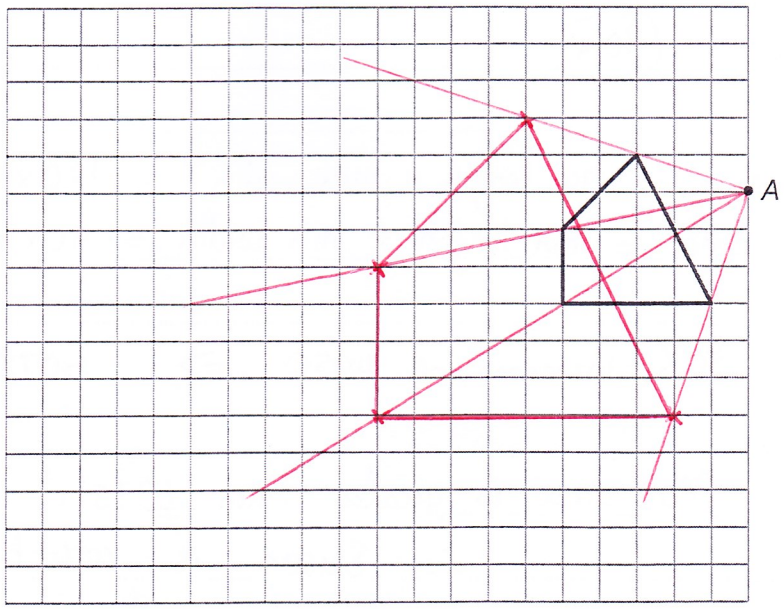
1. *(a)* Draw a reflection of the triangle in the line $y = 1$. [2]



(b) Enlarge the shape shown on the grid by a scale factor of 2, using A as the centre of the enlargement. [3]



Examiner only

2. The ruling body for international football has rules for the dimensions of rectangular football pitches.

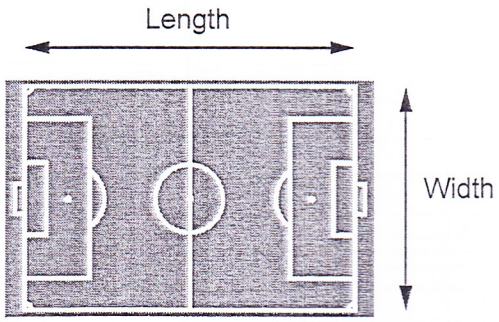


Diagram not drawn to scale

Football pitch dimension rules:

- the minimum width is 45 m
- the maximum width allowed is double the minimum width
- the maximum length is 120 m
- the minimum length allowed is three-quarters of the maximum length

(a) *You will be assessed on the quality of your written communication in this part of the question.*

Susan says

'The maximum area of a pitch is **at least 50%** greater than the minimum area of a pitch.'

Is Susan correct?
You must show all your working to justify your answer. [6]

Min width = 45m Max width = 90m

Min length = 3/4 of 120 Max length = 120m
= 90m

Max area = max length × max width = 120 × 90 = $10800\ m^2$

Min area = min length × min width = 90 × 45 = $4050\ m^2$

50% increase of 4050 ⇒ $6075\ m^2$

Max area is greater than $6075\ m^2$

∴ Susan is correct.

Examiner only

(b) Ceri makes a correct statement.
Complete Ceri's statement below using a decimal, correct to 2 decimal places. [2]

'Minimum area of a football pitch x 2·67 = maximum area of a football pitch.'

$\frac{10800}{4050} = 2·67$

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3. *(a)* In 2013, there were 119 days on which there was rain or snowfall in Moscow.
For what fraction of the number of days in 2013 was there **no** rain and **no** snowfall in Moscow? [1]

$365 - 119 = 246$ ∴ $\frac{246}{365}$

(b) The mean temperature in Moscow for a 12 month period is 4°C.
It is warmest in July, typically 26°C.
What would be the estimate for the mean temperature in Moscow if the temperature for July was not included? [4]

12 months mean = 4°C ∴ Total = $12 \times 4 = 48°C$

∴ Without July Total of temps = $48 - 26 = 22°C$

∴ Mean of remaining 11 months

$= \frac{22}{11} = 2°C$

(c) One year, during the 31 days in March, the temperature was recorded every day at midday.
The results are shown in the table below.

Midday temperature, t, in °C	Number of days	Mid Point
$-12 \leqslant t < -10$	1	−11
$-10 \leqslant t < -8$	3	−9
$-8 \leqslant t < -6$	5	−7
$-6 \leqslant t < -4$	8	−5
$-4 \leqslant t < -2$	4	−3
$-2 \leqslant t < 0$	10	−1

Calculate an estimate for the mean midday March temperature in Moscow.
You must show all your working. [4]

Mean $= \frac{1\times(-11) + 3\times(-9) + 5\times(-7) + 8\times(-5) + 4\times(-3) + 10\times(-1)}{31}$

$= \frac{-11 - 27 - 35 - 40 - 12 - 10}{31}$

$= \frac{-135}{31} = -4{\cdot}35°C$

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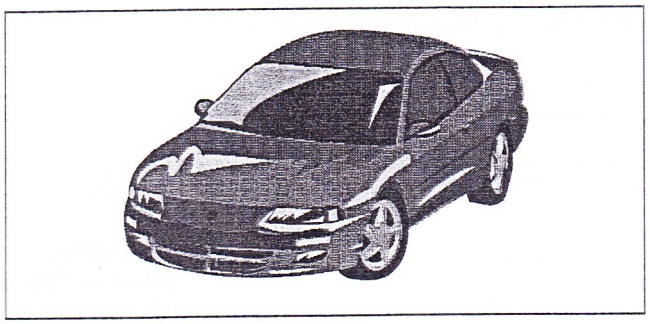
(d) Boris bought a car in Moscow for 251 850 Russian roubles.



(i) Each year, the value of Boris's car depreciates by 10% of its value at the start of the year.
At the end of two years, by how much has the value of Boris's car depreciated? [4]

Value after 2 years = $251\,850 \times 0.9^2$

= 203 998·5 Russian Roubles

∴ Depreciates by 251 850 − 203 998·5

= 47 851·50

Russian roubles

(ii) The exchange rate for Russian roubles when Boris bought his car was £1 = 50.37 Russian roubles.

At the same time, Angharad bought a car in Wales.
Angharad paid £5250 for her car.

How much more than Boris did Angharad spend on buying her car?
Give your answer in pounds. [3]

BORIS 251 850 ÷ 50·37 = £5000

ANGHARAD spends £250 more on her car.

Examiner only

4. The table shows some of the values of $y = x^3 + 6$ for values of x from –2 to 3.

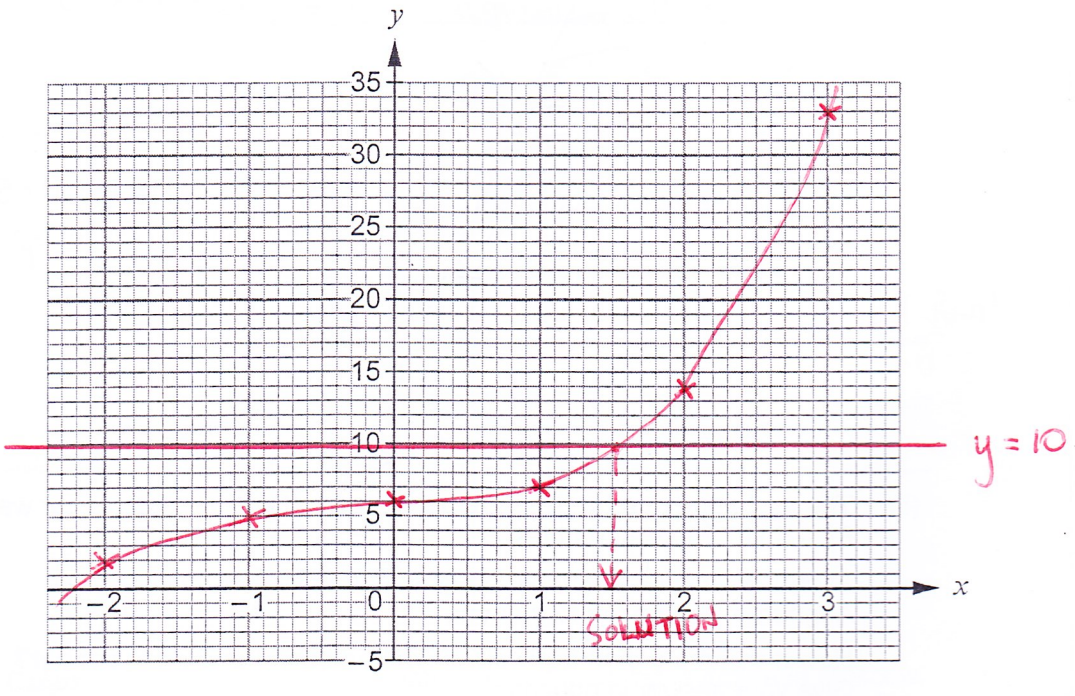
(a) Complete the table by finding the value of y for $x = -1$ and $x = 2$. [2]

x	–2	–1	0	1	2	3
$y = x^3 + 6$	–2	5	6	7	14	33

$x = -1$
$y = (-1)^3 + 6$
$y = -1 + 6$
$y = 5$

$x = 2$
$y = (2)^3 + 6$
$y = 8 + 6$
$y = 14$

(b) On the graph paper below, draw the graph of $y = x^3 + 6$ for values of x from –2 to 3. [2]



(c) Faye wants to solve the equation $x^3 + 6 = 10$ by first drawing a line on the graph above.
Show how Faye would do this on the graph above.
You do not need to find the solution of the equation. [1]

curve
line $y = 10$

Examiner only

5. Claudia was given the following information.

UK Income Tax

April 2013 to April 2014

taxable income = gross income – personal allowance

- personal allowance is £9205
- basic rate of tax: 20% on the first £32255 of taxable income
- higher rate tax: 40% is payable on all taxable income over £32255

During the tax year 2013 to 2014, Claudia's gross income was £52250.

Calculate the total amount of tax that Claudia should pay.
You must show all your working. [6]

Taxable Income = 52250 − 9205 = £43045

20% tax paid on £32,255 = 32255 ÷ 10 x 20

20% TAX — TAX PAID = £6450

40% tax paid on difference above £32255

ie 40% tax paid on 43045 − 32255 = £10790

40% TAX — TAX PAID = 10790 ÷ 100 x 40 = £4316

TOTAL TAX = 6450 + 4316 = £10766

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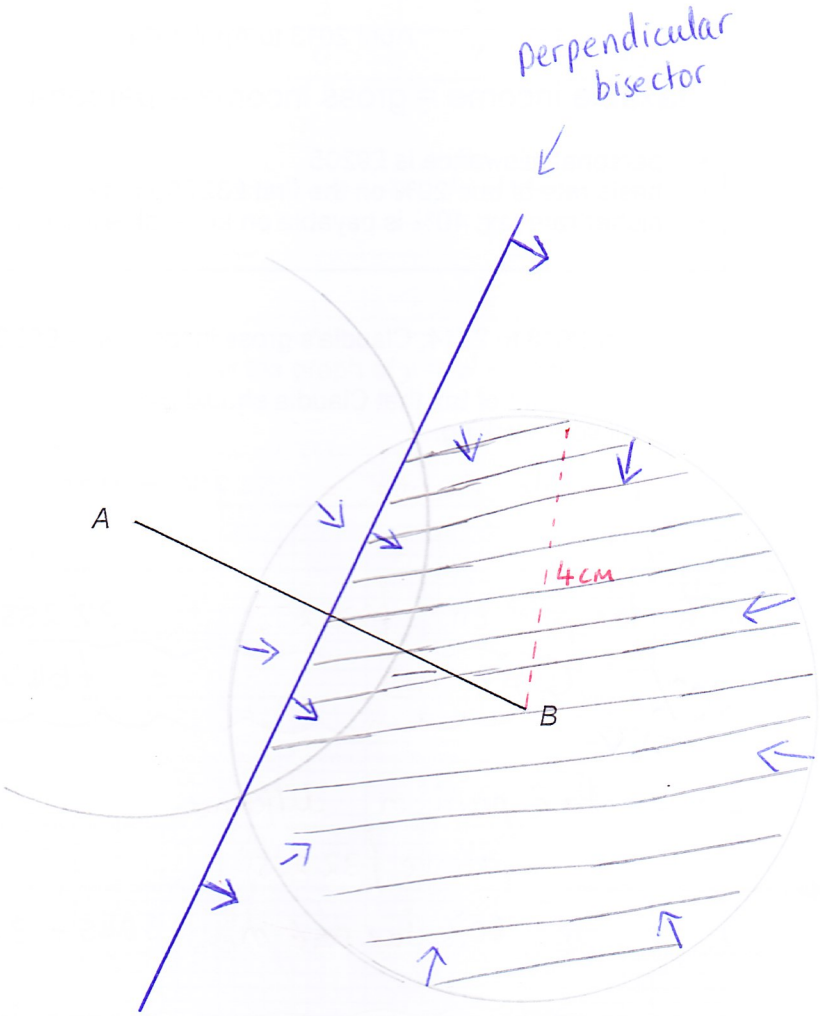
Examiner only

6. Shade the region that satisfies both of the following conditions.

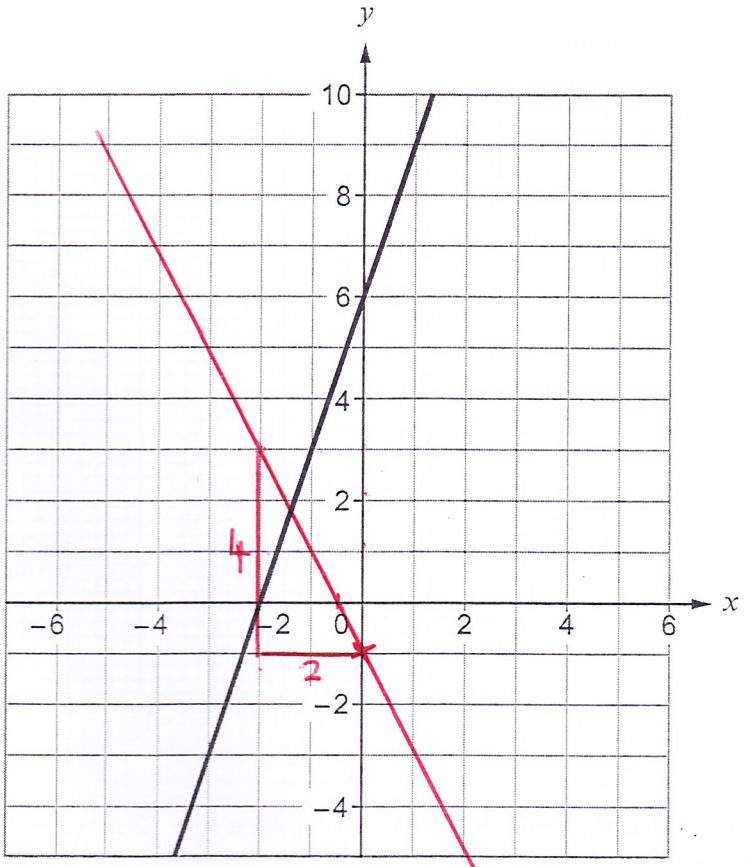
(i) The points are less than 4 cm from *B*.

(ii) The points are nearer to *B* than to *A*. [3]



Examiner only

7. *(a)* Find the equation of the straight line shown in the following diagram. Write your answer in the form $y = mx + c$. [2]



crosses y axis at +6

Gradient = $\frac{\text{ht}}{\text{base}} = \frac{6}{2} = 3$ +3 because

Equation of the straight line is $y =$ 3 $x +$ 6

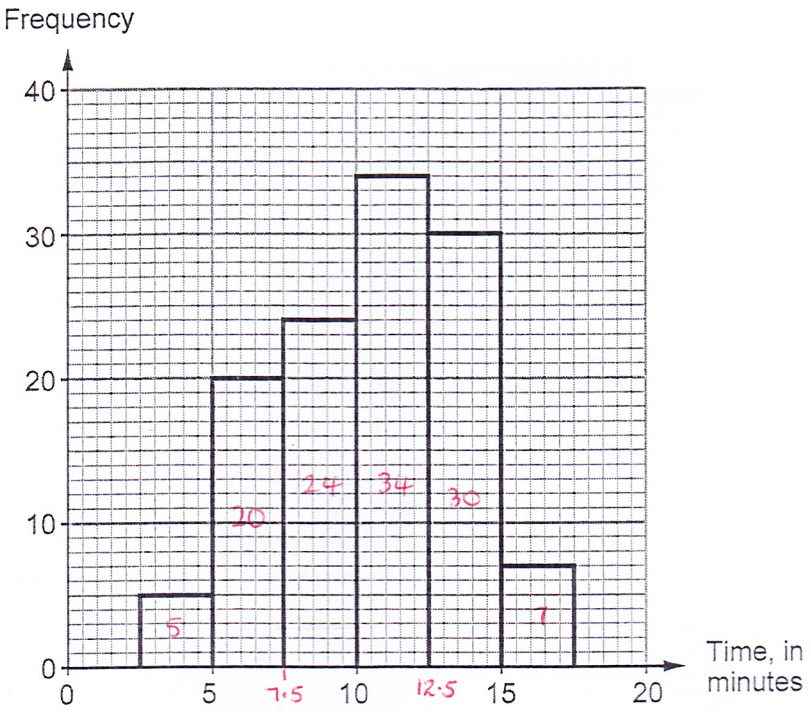
(b) On the grid above, draw the straight line which has a gradient of –2 and which passes through the point (0, –1). [2]

$\frac{\text{ht}}{\text{base}} = 2$

– sign means

Examiner only

8. A number of people took part in a challenge to swim across a lake.
The grouped frequency diagram shows the times taken to cross the lake.



(a) How many people took between 5 minutes and 12 minutes 30 seconds to swim across the lake? [1]

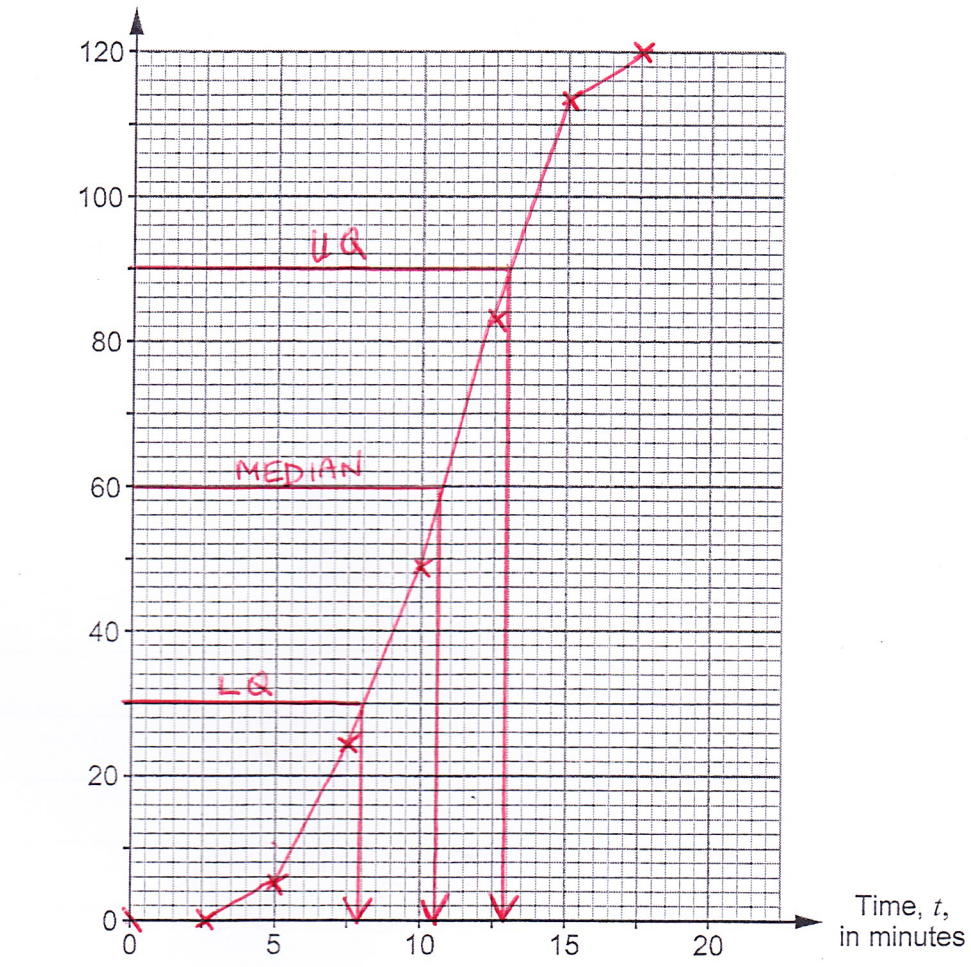
20 + 24 + 34
= 78

(b) Complete the cumulative frequency table for the swimming times. [2]

Time, t in minutes	$t \leqslant 2{\cdot}5$	$t \leqslant 5$	$t \leqslant 7{\cdot}5$	$t \leqslant 10$	$t \leqslant 12{\cdot}5$	$t \leqslant 15$	$t \leqslant 17{\cdot}5$
Cumulative frequency	0	5	25	49	83	1213	1820

Examiner only

(c) Use the graph paper below to draw a cumulative frequency diagram for the swimming times. [2]



(d) Use your cumulative frequency diagram to find

(i) an estimate for the median swimming time, [1]

median = 60th result 10·5 mins

(ii) an estimate for the inter-quartile range of the swimming times. [2]

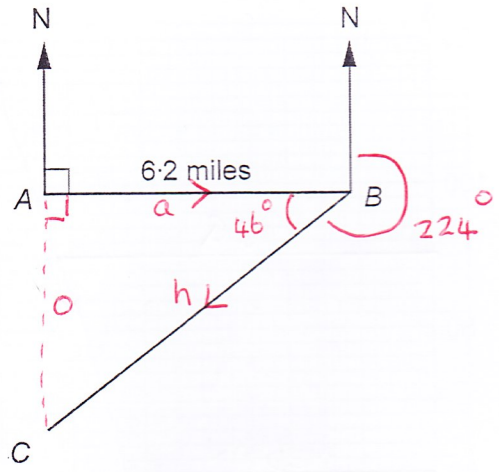
LQ = 30th result = 8 mins

UQ = 90th result = 13 mins

∴ IQR = 13 − 8 = 5 mins

Examin only

9. A ship leaves port *A* and sails for 6·2 miles on a bearing of 090° to a point *B*. It then turns and sails on a bearing of 224° until it reaches point *C*, which is due south of port *A*.
Calculate the distance between the point *C* and port *A*. [4]



224 + 46° = 270°

Diagram not drawn to scale

$\tan x = \frac{O}{a}$

Use △ABC $\tan 46^\circ = \frac{AC}{6.2}$

$6.2 \tan 46^\circ = AC$

6·42 miles = AC

Examiner only

10. *(a)* Factorise and hence solve $x^2 - 4x - 12 = 0$. [3]

$(x-6)(x+2) = 0$

x	+
−12	−4
(−6)	
(+2)	

either $x - 6 = 0$ or $x + 2 = 0$

$x = 6$ $\quad x = -2$

(b) Write down the nth term for each of the following sequences.

(i) 4, 9, 14, 19, 24, ... [2]

+5 +5 +5 +5

$5n - 1$

(ii) 2, 5, 10, 17, 26, 37, 50, ... [1]

+3 +5 +7 +9 +11 +13

+2 +2 +2 +2 +2 ← 2nd difference same

so n^2 formula

$n^2 + 1$

Examiner only

11. The probability that Ifor buys a sandwich for lunch is 0·6.
The probability that Ifor buys a sandwich and a drink for lunch is 0·18.
Buying a sandwich for lunch and buying a drink for lunch are independent events.

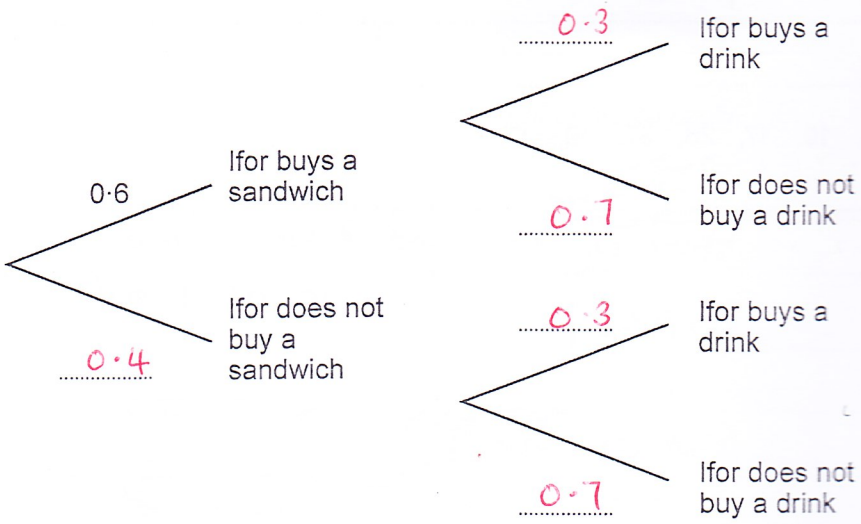
(a) (i) Find the probability that Ifor buys a drink for lunch. [2]

$0{\cdot}6 \times x = 0{\cdot}18$

$x = \frac{0{\cdot}18}{0{\cdot}6} = \frac{18}{60} = \frac{3}{10} = 0{\cdot}3$

Probability that Ifor buys a drink = 0·3

(ii) Complete the tree diagram. [2]



(b) Find the probability that Ifor does not buy a sandwich and does not buy a drink at lunchtime. [2]

$0{\cdot}4 \times 0{\cdot}7$

$= 0{\cdot}28$

Examiner only

12. The diagram shows a parallelogram and a rectangle joined along a common side.

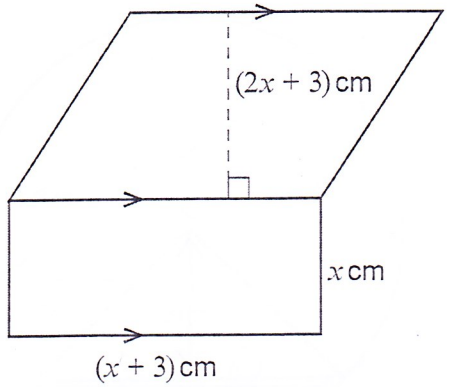


Diagram not drawn to scale

The width of the rectangle is x cm.
The length of the rectangle is $(x + 3)$ cm.
The height of the parallelogram is $(2x + 3)$ cm.
The total area of the parallelogram and the rectangle together is 70 cm^2.

(a) Show that $3x^2 + 12x - 61 = 0$. [3]

Total Area = □ + parallelogram
= lw + lh
= $x(x+3) + (x+3)(2x+3)$
= $x^2 + 3x + 2x^2 + 3x + 6x + 9$
= $3x^2 + 12x + 9$

Now $3x^2 + 12x + 9 = 70$
$3x^2 + 12x - 61 = 0$

(b) Use the quadratic formula to calculate the length of the rectangle.
Give your answer correct to 2 decimal places. [4]

$a = 3 \quad b = 12 \quad c = -61$

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \dfrac{-(12) \pm \sqrt{(12)^2 - 4(3)(-61)}}{2(3)}$

$x = \dfrac{-12 \pm \sqrt{144 + 732}}{6} = \dfrac{-12 \pm \sqrt{876}}{6}$

$x = \dfrac{-12 \pm 29.597}{6}$

$x = \dfrac{-12 + 29.597}{6}$ or $x = \dfrac{-12 - 29.597}{6}$

$x = 2.93$ $\quad x = -6.93$ IMPOSSIBLE

∴ length = 2.93 cm + 3 = 5.93 cm

Examiner only

13.

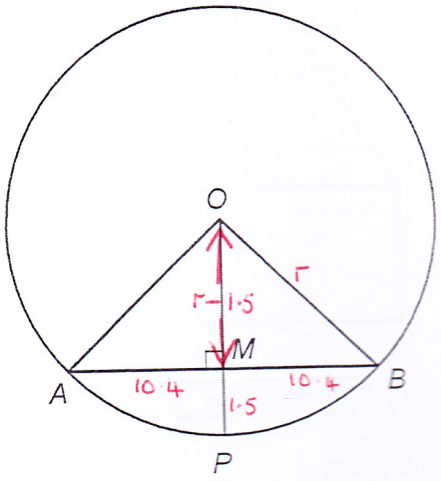


Diagram not drawn to scale

AOB is a sector of a circle, with *OP* perpendicular to *AB* and *AM* = *MB*.
You are given that *AB* = 20·8 cm and *MP* = 1·5 cm.
Calculate the radius of the circle. [6]

△ OMB

$OM = r - 1.5$

$MB = 10.4$

$h^2 = a^2 + b^2$

$r^2 = (r-1.5)^2 + 10.4^2$

$r^2 = r^2 + 2.25 - 3r + 10.4^2$

r^2 on both sides cancel out

$3r = 108.16 + 2.25$

$3r = 110.41$

$r = 36.8$ cm

Examiner only

14. The diagram shows a plan of drains connecting houses at points *A*, *B*, *C*, *P* and *Q*.

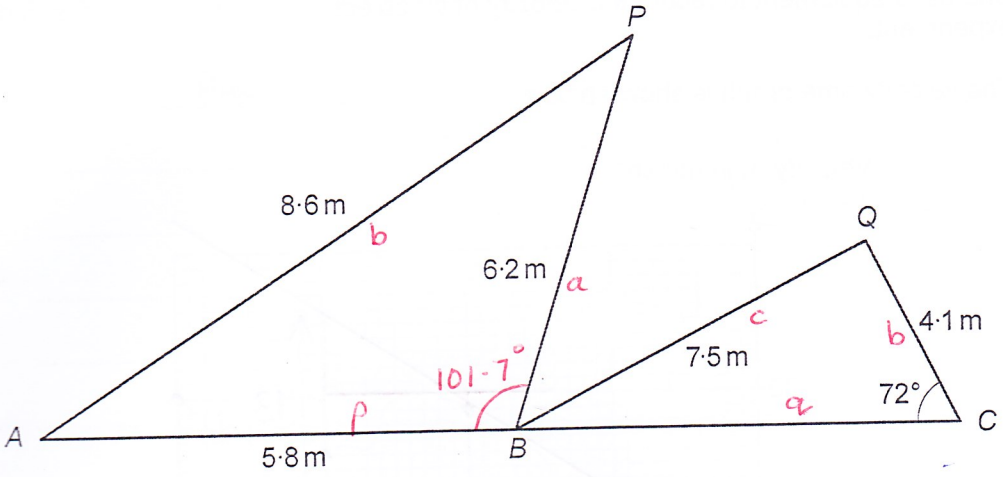


Diagram not drawn to scale

Given that *A*, *B* and *C* lie on a straight line, calculate the size of $P\hat{B}Q$.
Give your answer correct to the nearest degree. [7]

Use △ABP to calculate $A\hat{B}P$

$b^2 = a^2 + p^2 - 2ap\cos B$

$8.6^2 = 6.2^2 + 5.8^2 - 2(6.2)(5.8)\cos B$

$73.96 = 38.44 + 33.64 - 71.92\cos B$

$71.92\cos B = -1.88$

$\cos B = -1.88/71.92$

$A\hat{B}P = 91.5°$

Use △BCQ to calculate $C\hat{B}Q$

$\frac{b}{\sin B} = \frac{c}{\sin C} = \frac{q}{\sin Q}$

$\frac{4.1}{\sin B} = \frac{7.5}{\sin 72°}$

$\frac{\sin B}{4.1} = \frac{\sin 72°}{7.5}$

$\sin B = 4.1 \times \frac{\sin 72°}{7.5}$

$\sin B = 0.52$

$C\hat{B}Q = 31.3°$

$\therefore P\hat{B}Q = 180 - 91.5 - 31.5$

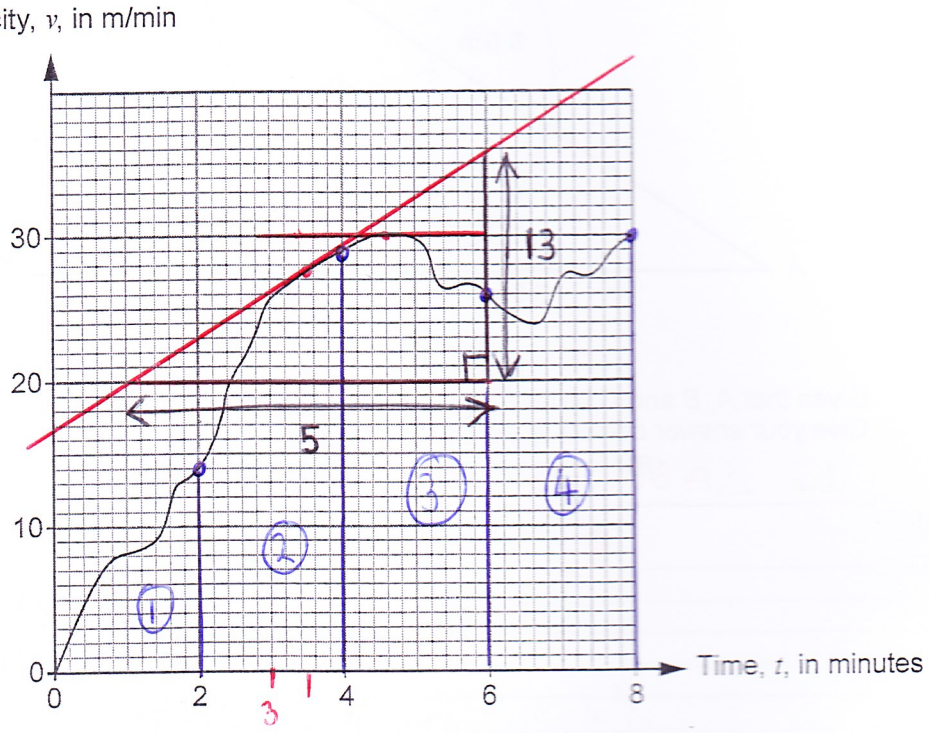
$= 57°$

$=$ to nearest degree

Examiner only

15. Polly carried out an experiment.
She used equipment to record the velocity of an object, v, in m/min for the first 8 minutes of the experiment.

The velocity-time graph is shown below.



(a) Write down the gradient of the curve when $t = 4{\cdot}6$. [1]

$m = 0$ (flat line)

(b) Find an estimate for the acceleration of the object at $t = 3{\cdot}5$. [3]

Acc = gradient of tangent = $\frac{\text{ht}}{\text{base}}$

$= \frac{13}{5}$

$= \frac{26}{10}$

$= 2{\cdot}6 \text{ m/min}^2$

Examiner only

(c) (i) Use the trapezium rule, with the ordinates $t = 0$, $t = 2$, $t = 4$, $t = 6$ and $t = 8$, to estimate the area of the region bounded by the curve, the positive time axis and the line $t = 8$. [4]

Area = ① + ② + ③ + ④

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

$= \left[\frac{2\times 14}{2}\right] + \left[\frac{(14+29)2}{2}\right] + \left[\frac{(29+26)2}{2}\right] + \left[\frac{(26+30)2}{2}\right]$

$= 14 + 43 + 55 + 56$

$= 168 \text{ units}^2$

(ii) Calculate an estimate for the distance the object travelled in the first 8 minutes of Polly's experiment, giving your answer in kilometres. [1]

Distance = area under graph $\approx$ 168 m

$\approx$ 0·168 km

END OF PAPER