

Surname		Centre Number	Candidate Number
Other Names			0



GCSE

4370/05

MATHEMATICS – LINEAR

PAPER 1

HIGHER TIER

A.M. TUESDAY, 6 November 2012

2 hours

SOLUTION

**CALCULATORS ARE
NOT TO BE USED
FOR THIS PAPER**

INSTRUCTIONS TO CANDIDATES

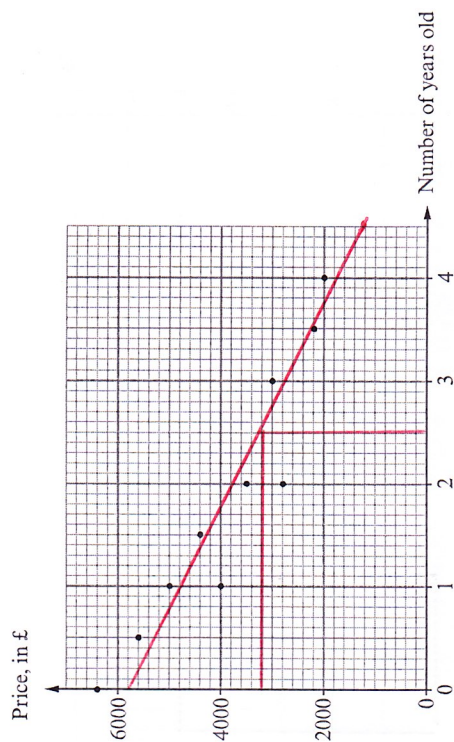
Use black ink or black ball-point pen.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer **all** the questions in the spaces provided.
Take π as 3.14.

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(a).

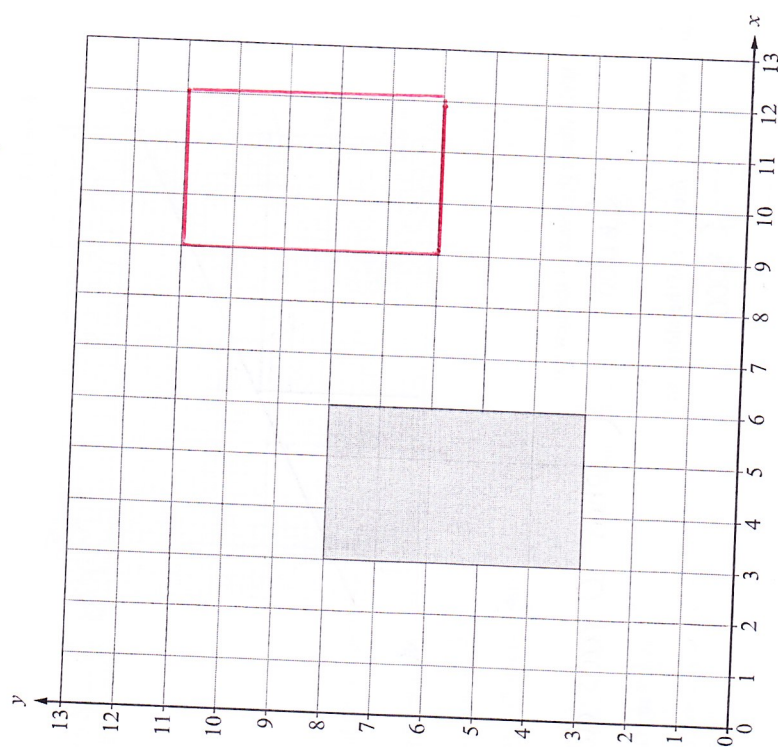
For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	5	
2	3	
3	6	
4	9	
5	9	
6	3	
7	4	
8	9	
9	9	
10	4	
11	7	
12	9	
13	3	
14	5	
15	7	
16	8	
TOTAL MARK		

1. The scatter diagram shows the price and age for each of 10 cars of the same make and model.



- (a) Write down the price of the new car.
£6400 (when 0 years old) [1]
- (b) Write down the price of the oldest car.
£2000 [1]
- (c) Draw, by eye, a line of best fit on the scatter diagram. [1]
- (d) Write down the type of correlation shown by the scatter diagram.
negative correlation [1]
- (e) Estimate the price of a $2\frac{1}{2}$ year old car of the same make and model.
£3200, correct use of line [1]

2. (a) Translate the rectangle shown 6 units to the right and 3 units up.

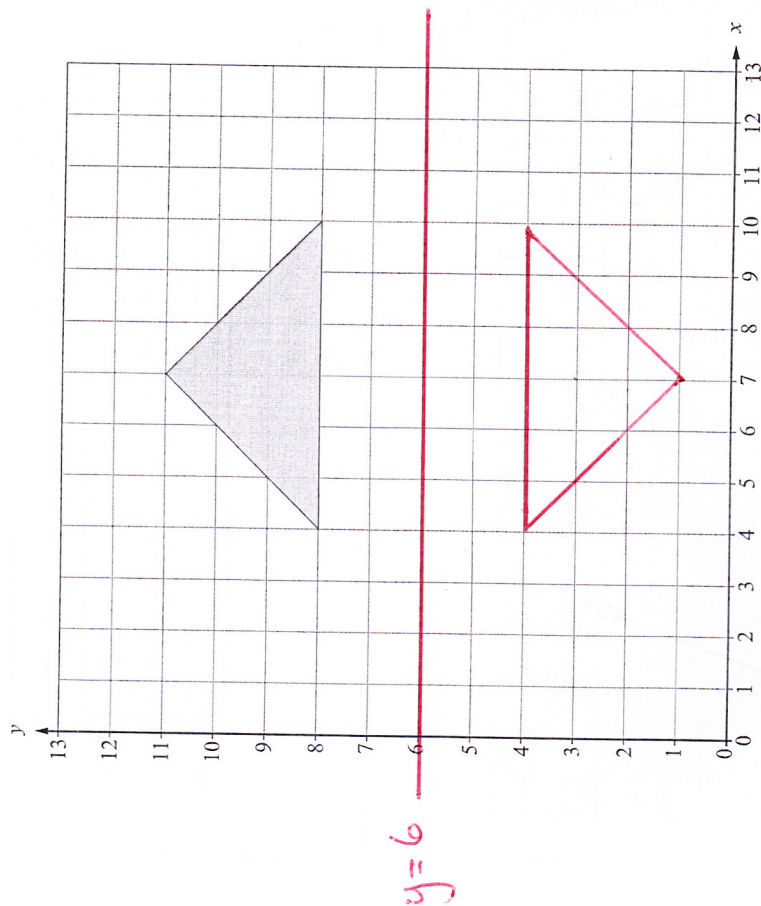


Examiner
only

[1]

- (b) Draw a reflection of the triangle in the line $y = 6$.

[2]

4170
050005

3. One day, Aled travels on his bike to the gym. Below is a description of his journey.

08:00	Leaves home
08:15	Stops at a friend's house on the way to the gym
08:36	Leaves his friend's house
09:00	Arrives at the gym
11:00	Leaves the gym
11:30	Arrives home

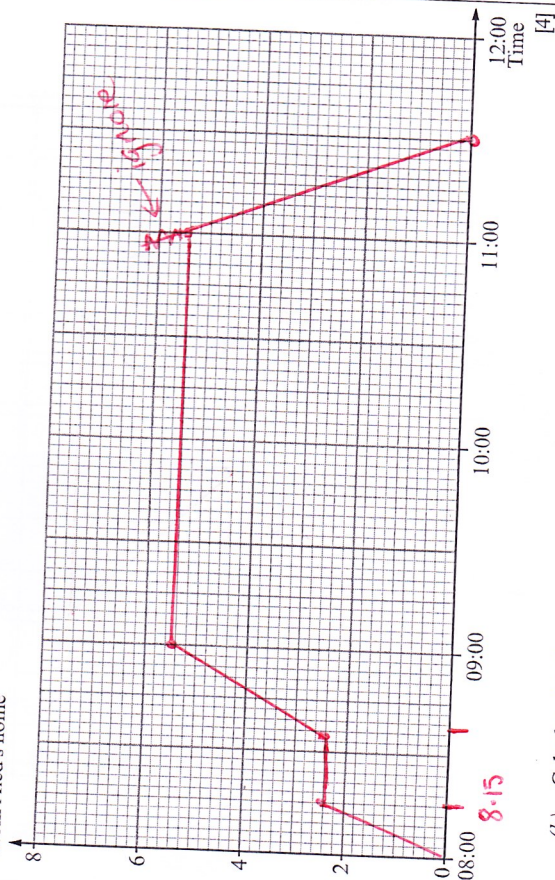
Aled's friend lives on his route to the gym.

Aled lives $2\frac{1}{2}$ miles away from his friend.

It is a further 3 miles from Aled's friend's house to the gym.

- (a) Use the information about Aled's journey to draw a travel graph on the graph paper below.

Distance, in miles,
from Aled's home



- (b) Calculate Aled's average speed, in mph, for his journey home.

$$S = \frac{D}{T} = \frac{5.5 \times 2}{0.5 \times 2} = \frac{11}{1} = 11 \text{ mph}$$

4. (a) Solve $6x - 7 = 2x + 21$.

$$6x - 2x = 21 + 7$$

$$4x = 28$$

$$x = \frac{28}{4}$$

$$x = 7$$

[3]

- (b) Factorise $24x + 3$.

$$= 3(8x + 1)$$

[1]

- (c) Factorise $x^2 - 6x$.

$$= x(x - 6)$$

[1]

- (d) Expand $2x(x^3 + 6)$.

$$= 2x^4 + 12x$$

[2]

- (e) Solve $\frac{x}{3} + 15 = 25$.

$$\frac{x}{3} = 25 - 15$$

$$\frac{x}{3} = 10$$

$$\times 3$$

$$x = 30$$

[2]

5. A community hall has a large number of rectangular tables and a large number of chairs. The tables can seat up to 3 people along each of the longer sides and 1 person at each end.

A street party is being organised using the community hall's tables and chairs. Tables are joined and placed in a long straight line.

Tables meet edge to edge to form the line.

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

What is the least number of tables needed to seat 164 people?

You must show all your working and explain how you arrive at your answer.



Each table has 6 seats except of 2 end ones which have 1 extra each

$$164 - 2 \text{ ends} = 162$$

$$\frac{162}{6} = 27 \text{ } \circ_s \text{ } 27 \text{ tables needed.}$$

Formula $P = 6t + 2$

↑ ↑ ↑

people 6 per table 2 end

[6]

- (b) There are n people sitting around a straight line of tables.
There are no empty seats.
Write an expression in terms of n for the least number of tables needed to seat these people.

$$\frac{n-2}{6} = t$$

OR If n people

$$\frac{n-2}{6} = \text{number of tables}$$

[3]

6. Roz and Simon each throw a fair dice.
Calculate the probability that the sum of the two numbers obtained is 4.

$$\begin{aligned}
 &P(1 \text{ and } 3 \text{ OR } 3 \text{ and } 1 \text{ OR } 2 \text{ and } 2) \\
 &= \left(\frac{1 \times 1}{6 \times 6}\right) + \left(\frac{1 \times 1}{6 \times 6}\right) + \left(\frac{1 \times 1}{6 \times 6}\right) \\
 &= \frac{1}{36} + \frac{1}{36} + \frac{1}{36} \\
 &= \frac{3}{36} \\
 &= \frac{1}{12}
 \end{aligned}$$

[3]

7. Seven **single digit numbers** have a median of 6 and a range of 8.
The mode of the seven numbers is 3.
Find the seven numbers.
Write your single digit numbers in order in the boxes.

1	3	3	6	7	8	9
---	---	---	---	---	---	---

↑
Median in
centre

[4]

8. (a) Estimate the value of $\frac{48 \times 21}{199}$.

$$\approx \frac{50 \times 20}{200} \approx \frac{1000}{200} \approx 5$$

[2]

- (b) Given that $46 \times 345 = 15870$, find the value of $\frac{1587}{460}$.
- $\frac{1587}{460} \approx \frac{1500}{500} \approx 3$ so the answer will be around 3.
- $\frac{0}{00} \frac{1587}{460} = 3.45$ from the sum above.

[1]

- (c) Write down the value of a half of $\frac{3}{8}$. Give your answer as a fraction.

$$\frac{1}{2} \text{ of } \frac{3}{8} = \frac{1}{2} \times \frac{3}{8}$$

$$= \frac{3}{16}$$

[1]

(d) Express 240 as a product of prime factors using index notation.

$$\begin{array}{r}
 2 \overline{) 240} \\
 \underline{2 120} \\
 2 60 \\
 \underline{2 30} \\
 3 15 \\
 \underline{5 5} \\
 1
 \end{array}
 \quad 240 = 2^4 \times 3 \times 5$$

[3]

(e) Evaluate the reciprocal of 0.9 and state whether this is greater or less than 0.9.

$$0.9 = \frac{9}{10}$$

$$\text{Reciprocal} = \frac{1}{0.9} = \frac{1 \times 10}{0.9 \times 10} = \frac{10}{9}$$

$$\frac{10}{9} > 0.9$$

[2]

9. (a) Expand and simplify $(2x + 5)(3x - 4)$.

$$= 6x^2 - 8x + 15x - 20$$

$$= 6x^2 + 7x - 20$$

[3]

- (b) Factorise $2x^2 + x - 3$ and hence solve $2x^2 + x - 3 = 0$.

$$= 2x^2 - 2x + 3x - 3$$

$$= 2x(x-1) + 3(x-1)$$

$$= (x-1)(2x+3)$$

$$2x^2 + x - 3 = 0$$

$$(x-1)(2x+3) = 0$$

either $x-1=0$ or $2x+3=0$

$$x=1 \quad 2x=-3$$

$$x=-3/2$$

[3]

- (c) Simplify $\frac{(x+5)^8}{(x+5)^2}$.

$$(x+5)^{8-2}$$

$$= (x+5)^6$$

[1]

(d) Write down the n th term of the sequence 5, 8, 13, 20, 29, ...

$$\begin{array}{r} 5 \\ +3 \\ \hline 8 \end{array}$$

$$\begin{array}{r} 8 \\ +5 \\ \hline 13 \end{array}$$

$$\begin{array}{r} 13 \\ +7 \\ \hline 20 \end{array}$$

$$\begin{array}{r} 20 \\ +9 \\ \hline 29 \end{array}$$

$$\begin{array}{r} 29 \\ +11 \\ \hline 40 \end{array}$$

$$\begin{array}{r} 40 \\ +13 \\ \hline 53 \end{array}$$

$$\begin{array}{r} 53 \\ +15 \\ \hline 68 \end{array}$$

$$\begin{array}{r} 68 \\ +17 \\ \hline 85 \end{array}$$

$$\begin{array}{r} 85 \\ +19 \\ \hline 104 \end{array}$$

$$\begin{array}{r} 104 \\ +21 \\ \hline 125 \end{array}$$

$$\begin{array}{r} 125 \\ +23 \\ \hline 148 \end{array}$$

$$\begin{array}{r} 148 \\ +25 \\ \hline 173 \end{array}$$

$$\begin{array}{r} 173 \\ +27 \\ \hline 200 \end{array}$$

$$\begin{array}{r} 200 \\ +29 \\ \hline 229 \end{array}$$

$$\begin{array}{r} 229 \\ +31 \\ \hline 260 \end{array}$$

$$\begin{array}{r} 260 \\ +33 \\ \hline 293 \end{array}$$

$$\begin{array}{r} 293 \\ +35 \\ \hline 328 \end{array}$$

$$\begin{array}{r} 328 \\ +37 \\ \hline 365 \end{array}$$

$$\begin{array}{r} 365 \\ +39 \\ \hline 404 \end{array}$$

$$\begin{array}{r} 404 \\ +41 \\ \hline 445 \end{array}$$

$$\begin{array}{r} 445 \\ +43 \\ \hline 488 \end{array}$$

$$\begin{array}{r} 488 \\ +45 \\ \hline 533 \end{array}$$

$$\begin{array}{r} 533 \\ +47 \\ \hline 580 \end{array}$$

$$\begin{array}{r} 580 \\ +49 \\ \hline 629 \end{array}$$

$$\begin{array}{r} 629 \\ +51 \\ \hline 680 \end{array}$$

$$\begin{array}{r} 680 \\ +53 \\ \hline 733 \end{array}$$

$$\begin{array}{r} 733 \\ +55 \\ \hline 788 \end{array}$$

$$\begin{array}{r} 788 \\ +57 \\ \hline 845 \end{array}$$

$$\begin{array}{r} 845 \\ +59 \\ \hline 904 \end{array}$$

$$\begin{array}{r} 904 \\ +61 \\ \hline 965 \end{array}$$

$$\begin{array}{r} 965 \\ +63 \\ \hline 1028 \end{array}$$

$$\begin{array}{r} 1028 \\ +65 \\ \hline 1093 \end{array}$$

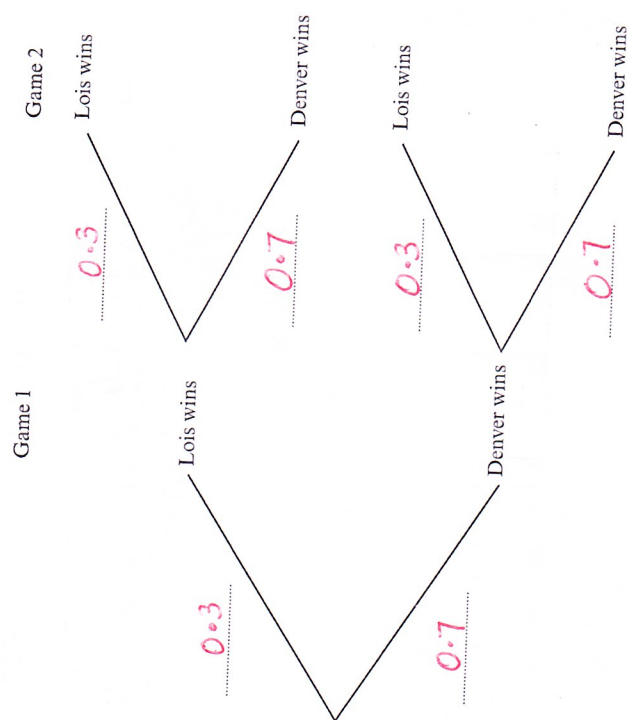
$$\begin{array}{r} 1093 \\ +67 \\ \hline 1160 \end{array}$$

$$\begin{array}{r} 1160 \\ +69 \\ \hline 1229 \end{array}$$

[2]

10. Whenever Lois and Denver play a game of Bubble on their computer, the probability that Lois wins is 0.3. No game of Bubble ever ends in a draw.

(a) Complete the following tree diagram to show the probabilities of what can happen when Lois and Denver play two games of Bubble.

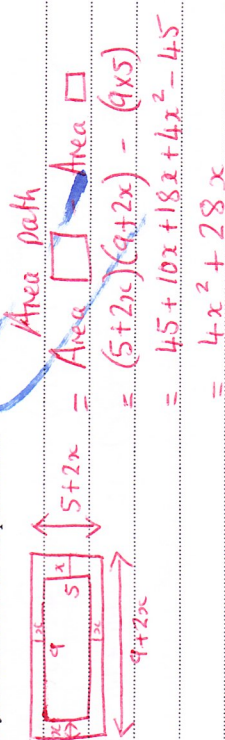


- (b) Calculate the probability that Denver wins both games of Bubble.

$$\begin{aligned}
 &P(D \text{ and } D) \\
 &= 0.7 \times 0.7 \\
 &= 0.49
 \end{aligned}$$

11. A rectangular lawn has a length of 9m and a width of 5m. A builder is asked to make a path of width x metres around the outside edge of the rectangular lawn.

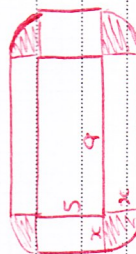
- (a) All the edges of the path are straight.
Find an expression for the area of the path in terms of x .
Give your answer in its simplest form.



$$\begin{aligned}
 \text{Area path} &= \text{Area of outer rectangle} - \text{Area of inner rectangle} \\
 &= (5+2x)(9+2x) - (9 \times 5) \\
 &= 45 + 10x + 18x + 4x^2 - 45 \\
 &= 4x^2 + 28x
 \end{aligned}$$

[4]

- (b) At the corners of the lawn it is possible to curve the outer edge of the path and still keep the width of the path equal to x metres.
Find an expression for the area of this path in terms of x and π .
Give your answer in its simplest form.



4 quarter circles
make 1 whole
circle

$$\begin{aligned}
 \text{Area path} &= 5x + 5x + 9x + 9x + \pi x^2 \\
 &= 28x + \pi x^2 \\
 &= x(28 + \pi x)
 \end{aligned}$$

[3]

12. The table shows values of $y = -x^2 + 8x - 12$ for values of x from 1 to 8.

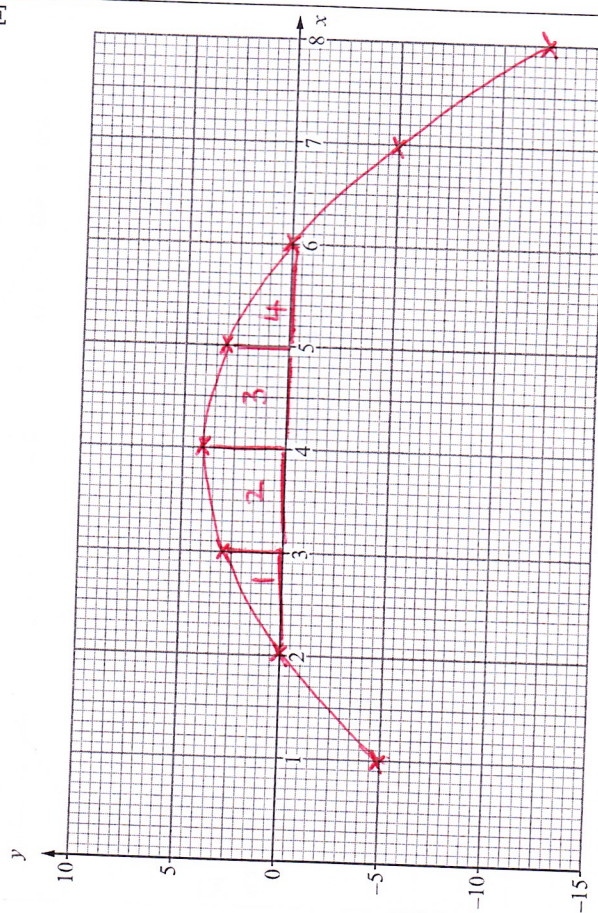
x	1	2	3	4	5	6	7	8
$y = -x^2 + 8x - 12$	-5	0	3	4	3	0	-5	-12

- (a) Complete the table above.

$$x=7 \quad y = -7^2 + 8(7) - 12 = -49 + 56 - 12 = -5$$

$$x=8 \quad y = -8^2 + 8(8) - 12 = -64 + 64 - 12 = -12$$

- (b) On the graph paper below, draw the graph of $y = -x^2 + 8x - 12$ for the values of x from 1 to 8. [2]



- (c) Use your graph to write down the solutions of the equation $-x^2 + 8x - 12 = 0$.

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

[1]

- (d) Use the trapezium rule, with the ordinates $x = 2$, $x = 3$, $x = 4$, $x = 5$ and $x = 6$, to estimate the area of the region enclosed by the curve and the x -axis.

$$\begin{aligned} \text{Area} &= \textcircled{1} + \textcircled{2} + \textcircled{3} + \textcircled{4} \\ &= \frac{bh}{2} + \frac{(a+b)h}{2} + \frac{(a+b)h}{2} + \frac{bh}{2} \\ &= \frac{1 \times 3}{2} + \frac{(3+4)1}{2} + \frac{(4+3)1}{2} + \frac{1 \times 3}{2} \\ &= 1.5 + 3.5 + 3.5 + 1.5 \\ &= 10 \text{ units}^2 \end{aligned}$$

[4]

13. Given that y is inversely proportional to x^2 , and that $y = 10$ when $x = 12$, find an expression for y in terms of x .

$$y = \frac{k}{x^2}$$

$$10 = \frac{k}{12^2}$$

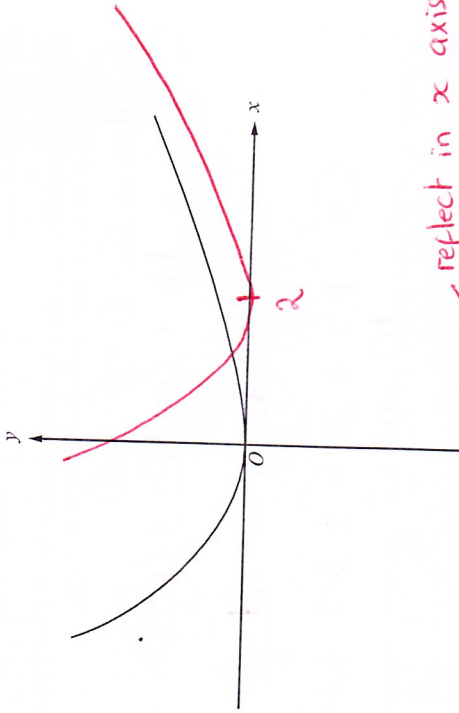
$$10 \times 144 = k \quad \text{so} \quad y = \frac{1440}{x^2}$$

$$1440 = k$$

[3]

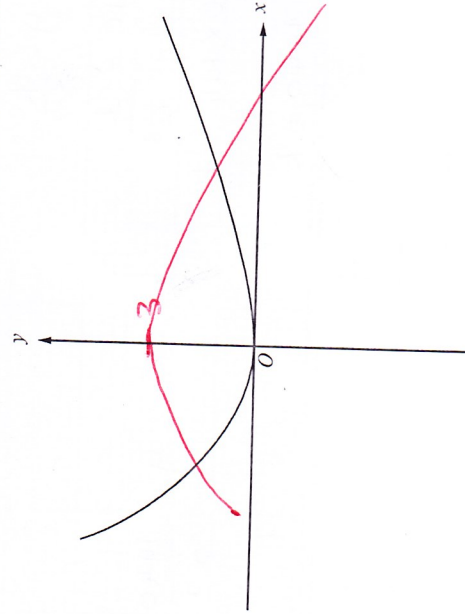
14. (a) The diagram shows a sketch of $y = f(x)$.
On the same diagram, sketch the curve $y = f(x - 2)$.
Mark clearly the coordinates of the point where this curve touches an axis.

shift 2
places right



reflect in x axis
move 3
places up

- (b) The diagram shows another sketch of $y = f(x)$.
On the same diagram, sketch the curve $y = -f(x) + 3$.
Mark clearly the coordinates of the point where this curve meets the y-axis.



15. (a) Express $400\sqrt[3]{2}$ as a fraction.

$$= \frac{1}{400\sqrt[3]{2}} = \frac{1}{(\sqrt[3]{400})^3} = \frac{1}{8000}$$

[2]

- (b) Express $0.6\dot{5}2$ as a fraction.

$$\text{Let } x = 0.6\dot{5}2$$

$$100x = 65\dot{2}.5\dot{2}$$

$$10x = 6.\dot{5}2$$

$$\text{Sub } 990x = 646$$

$$x = \frac{646}{990} = \frac{323}{495}$$

[2]

- (c) Simplify $(3 - 5\sqrt{2})^2$ and state whether your answer is rational or irrational.

$$= (3 - 5\sqrt{2})(3 - 5\sqrt{2})$$

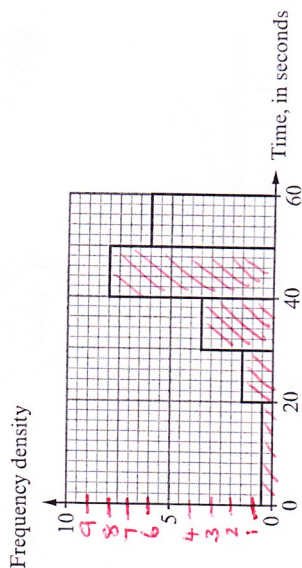
$$= 9 - 15\sqrt{2} - 15\sqrt{2} + 25(2)$$

$$= 59 - 30\sqrt{2}$$

Irrational because
of $\sqrt{2}$

[3]

16. (a) The time taken to sew a button on a shirt was measured for each child in a group of 200 children. The histogram below illustrates the results obtained.



Use the histogram to calculate how many of the children took less than 50 seconds to sew a button on a shirt.

$$\begin{aligned}
 \text{Number} &= \text{Areas} = (0.5 \times 20) + (1.5 \times 10) + (3.5 \times 10) + (8 \times 10) \\
 &= 10 + 15 + 35 + 80 \\
 &= 140 \text{ children.}
 \end{aligned}$$

[3]

- (b) The time taken to sew a button on a shirt was measured for each adult in a group of 200 adults.

The following grouped frequency distribution was obtained.

Time, t seconds	$0 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 50$	$50 < t \leq 60$
Number of adults	20	20	25	35	100

← 100 → 100

- (i) Find an estimate of the median of this distribution.

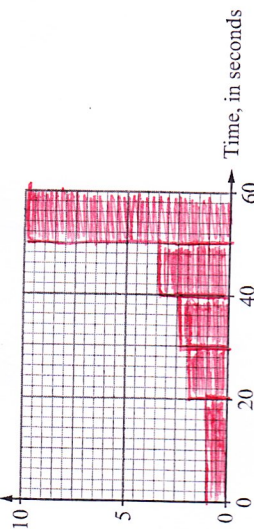
Median = 100th result from table 50 secs

- (ii) Draw the histogram to illustrate the distribution on the graph paper below.

Frequency Density $\frac{20}{20} = 1$ $\frac{20}{10} = 2$ $\frac{25}{10} = 2.5$

$\frac{35}{10} = 3.5$ $\frac{100}{10} = 10$

Frequency density



- (c) Using the information from parts (a) and (b), do you think the adults are faster than the children at sewing buttons on shirts? You must give a reason for your answer.

No. The adults are slower as the peak bar for adults is on the highest time.