

WELSH JOINT EDUCATION

COMMITTEE

GCSE LEVEL

PAST PAPERS

MATHEMATICS NOV 1996

MATHEMATICS

TIER A PAPER 1

A.M. TUESDAY, 12 November 1996

(2½ hours)



Centre Number

Candidate's Name (in full)

Candidate's Examination Number

INSTRUCTIONS TO CANDIDATES

Write your centre number, name and candidate number in the spaces provided above.

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

INFORMATION FOR CANDIDATES

An electronic calculator will be required.

A formula booklet is available and may be used.

You should give details of your method of solution, especially when a calculator is used.

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.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	5	
2	3	
3	5	
4	4	
5	7	
6	4	
7	5	
8	4	
9	7	
10	3	
11	3	
12	9	
13	6	
14	10	
15	6	
16	8	
17	3	
18	8	
TOTAL		

1. Solve the following simultaneous equations by an algebraic (not graphical) method.

$$\begin{aligned} 5x + 3y &= 3 \\ 4x - 2y &= 20 \end{aligned}$$

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.....

[5]



2. Do not use a calculator when answering this question.
All working must be shown.

Show clearly how you would obtain an ESTIMATE for the following.

$$\frac{\sqrt{97.8}}{51 \times 0.00187}$$

.....

.....

.....

.....

[3]

3. (a) Show how you would use your calculator to calculate the value of:

$$\frac{46.3 \times 52.6}{23.1 - 5.67}$$

Write each key you would use in a separate box.

Answer =

[3]

- (b) Evaluate

$$\frac{(4.92)^3}{739 \times 68}$$

Answer = (correct to 2 significant figures)

[2]

4. Use the graph paper provided to draw the graph of

$$y = 5 - 2x$$

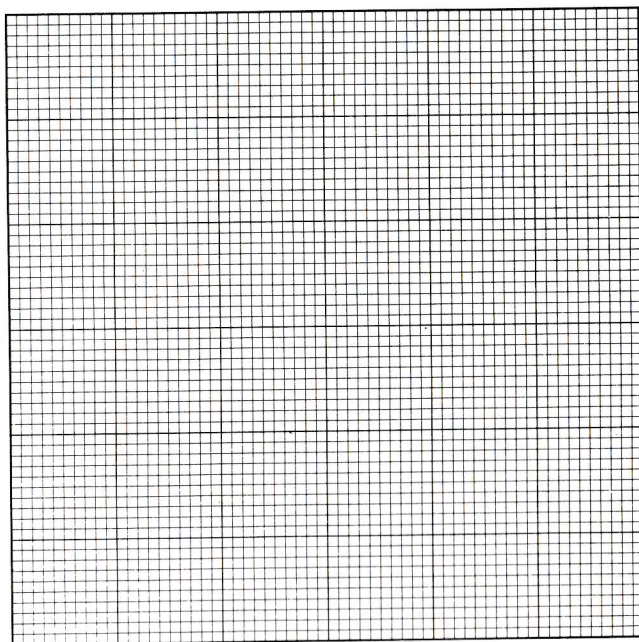
for values of x between $x = 0$ and $x = 5$ inclusive.

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[4]

5.

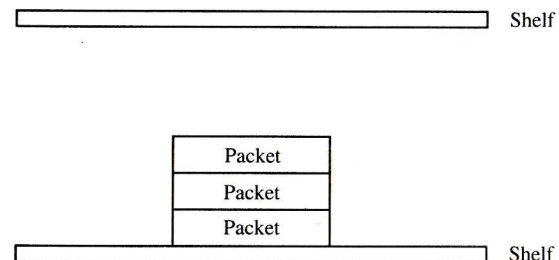


Diagram is not drawn to scale

Packets are to be stacked on top of each other on shelves.

- (a) The packets have a height of 66 mm measured to the nearest millimetre. Write down the least and greatest possible values for the height of a packet:

Least = mm Greatest = mm [1]

- (b) Seven of these packets are stacked one on top of the other. Write down the least and greatest possible values for the height of the stack of seven packets:

Least = mm Greatest = mm [2]

- (c) Explain, showing all your calculations, why it is not always possible to stack 7 packets on shelves, which are made 47 cm apart, measured to the nearest cm, but it is always possible to stack 7 packets on shelves, which are made 48 cm apart, measured to the nearest cm.

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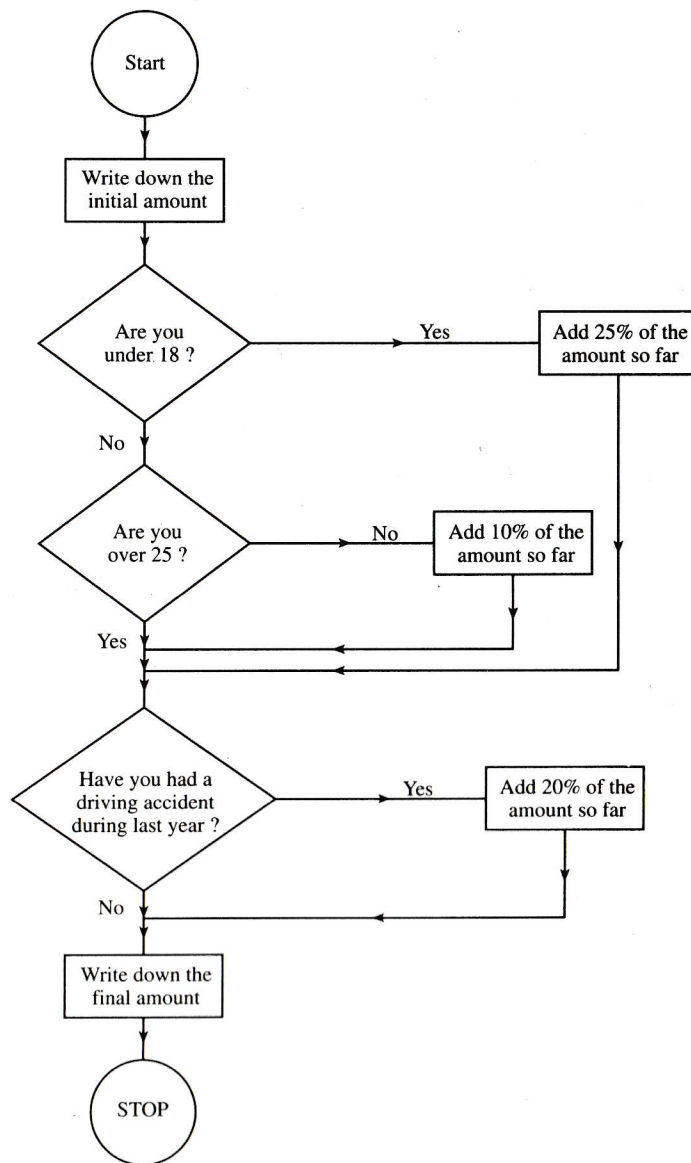
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[4]

Turn over.

6. The following flowchart is used to find the amount paid for car insurance. You start with an initial amount and end up with the final amount to be paid.



Using the flowchart write down the details of the calculations of the final amount to be paid if you were the following people.

- (a) Malcolm, aged 17, no accident last year, with an initial amount of £480.

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[2]

- (b) Cliff, aged 24, had an accident last year, with an initial amount of £650.

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[2]

7. (a) Write each of the following numbers in standard form.

(i) 0.000083

[1]

(ii) 96 000 000 000

[1]

- (b) Find, in standard form, the value of

(i) $(9.45 \times 10^{-7}) \times (6.21 \times 10^3)$,

[1]

(ii) $\frac{(6.21 \times 10^3)}{(9.45 \times 10^{-7})}$.

[2]

8. (a) Calculate, in fractional form, the value of

$$a - \frac{1}{2}bc$$

where $a = \frac{2}{3}$, $b = \frac{1}{3}$, and $c = 1\frac{1}{2}$

[2]

- (b) Calculate the value of

$$rs + pt^2$$

when $r = -12$, $s = 5$, $p = 3$ and $t = -4$.

[2]

9. (a) Factorise $3x^2 - 6xy$.

[2]

- (b) Expand the following expression, simplifying your answer as far as possible.

$$(3x - 2)(2x + 5)$$

[2]

- (c) Make p the subject of the following, simplifying your answer as far as possible.

$$\frac{p}{3} - d = 2(a + d)$$

[3]

10. (a) Rearrange the inequality

$$2 < 3n - 7 \leq 16$$

into the form $a < n \leq b$, where a and b are numbers.

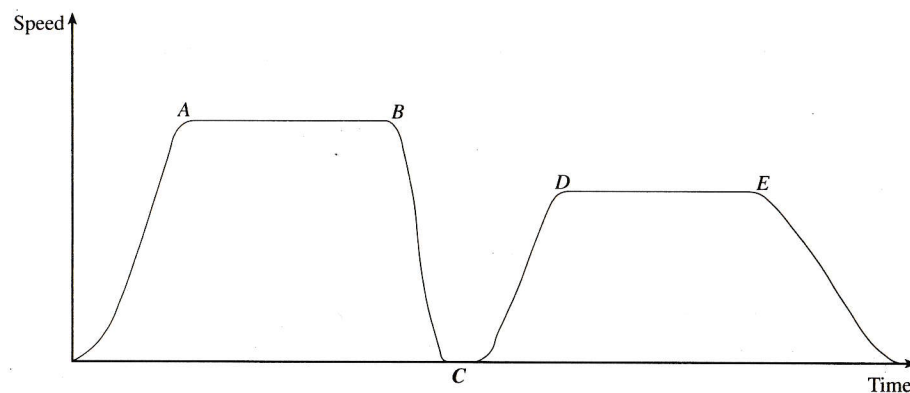
[2]

- (b) Write down the whole number values of n that satisfy your inequality.

[1]

Turn over.

11. Paul runs in a race. The diagram shown below, is the speed-time graph for Paul whilst he was in the race.



- (i) Describe what you think happened to Paul during the period marked BCD .

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.....

- (ii) What do the parts AB and DE tell you about Paul's speed ?

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[3]



12. Do not use a calculator when answering this question. All working must be shown.

- (a) Write down an irrational number between 4 and 5.

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.....

[1]

- (b) Show clearly that **each** of the following is rational.

(i) $16^{\frac{3}{4}}$

.....

.....

(ii) $9^{-\frac{3}{2}}$

.....

.....

[4]

- (c) Two different irrational numbers are represented by a and b .

- (i) Give an example of a and b for which a divided by b is rational.

.....

.....

- (ii) Give an example of a and b for which a divided by b is irrational.

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.....

[4]

13. The length and width of the base of a cuboid are 16 cm and 9 cm respectively. The height of the cuboid is 4 cm. All lengths are measured correct to the nearest centimetre.

(a) (i) Calculate the maximum and minimum possible area of the base of the cuboid.

.....

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.....

(ii) The area of the base of the cuboid is given as 144 cm^2 . Calculate the maximum possible error in this value.

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[3]

(b) The volume of the cuboid is given as 576 cm^3 . Calculate the maximum possible error in this value.

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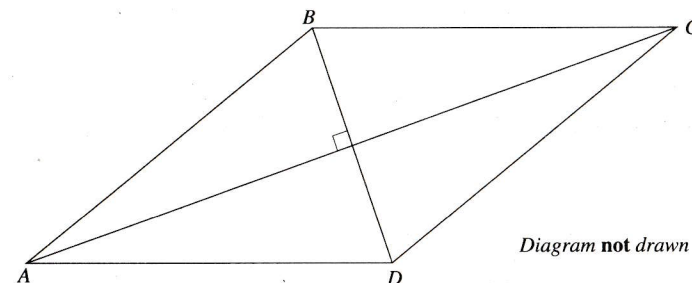
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[3]

14. The length of the side of a rhombus, $ABCD$, is 9 cm, correct to the nearest centimetre. The length of the shorter of its two diagonals, BD , is 7 cm, correct to the nearest centimetre.



(a) Calculate the minimum possible length of the other diagonal, AC .

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[5]

(b) Calculate the minimum possible value of $\hat{BAD}$.

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[5]

15. The amount of energy stored in an elastic band, which has been extended x cm is denoted by E Joules. It is known that E is proportional to x^2 .

(a) Using k as the constant of proportionality, write down an equation for E in terms of k and x .

[1]

(b) In an experiment to determine the value of k , the following results were obtained.

Extension, x cm	2	4	6	7
Energy, E Joules	124	476	1072	1478

Substitute each of the four pairs of values given in the table into the equation you have found in (a) and hence estimate the value of k to the nearest whole number.

[3]

(c) Using your estimate for k , write down the formula connecting E and x .

[1]

(d) Use your formula to estimate the energy that is stored in the elastic band when it is extended by 5.5 cm.

[1]

16. The graph opposite shows the curve

$$y = 4 - x^2$$

between $x = -4$ and $x = 5$.

(a) Use the graph to calculate the gradient of the curve at $x = -1$.

[3]

(b) Without using the graph, explain why the value of y in the equation

$$y = 4 - x^2$$

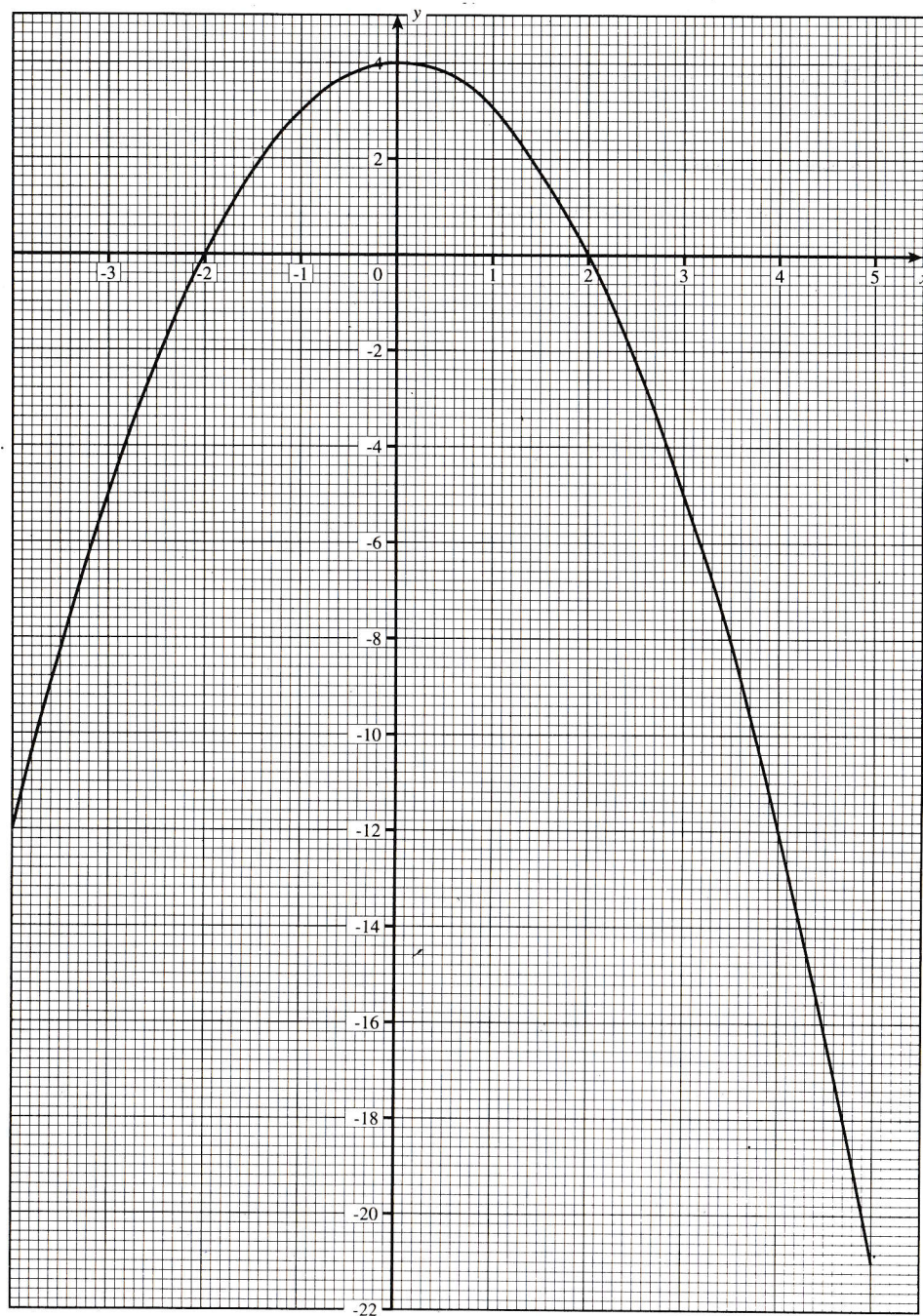
will never exceed 4.

[1]

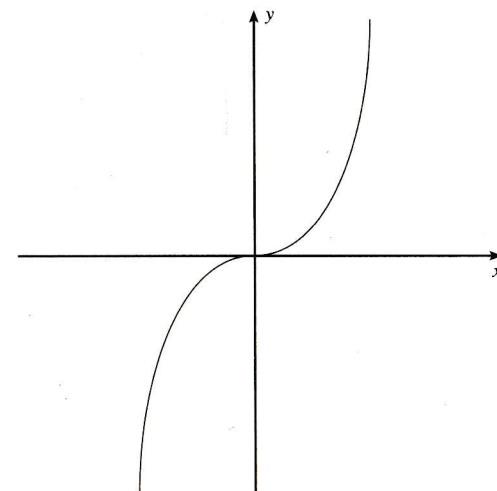
(c) By drawing an appropriate line on the graph, solve the equation

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

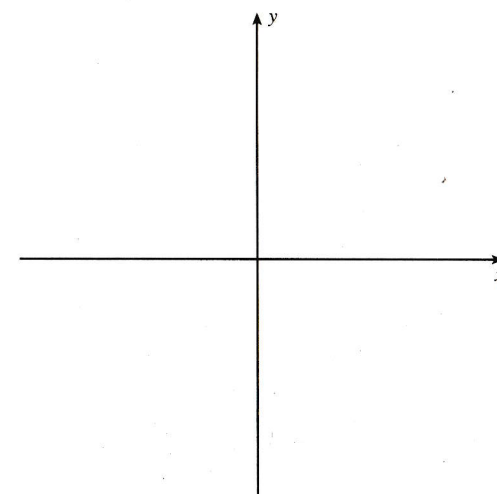
[4]



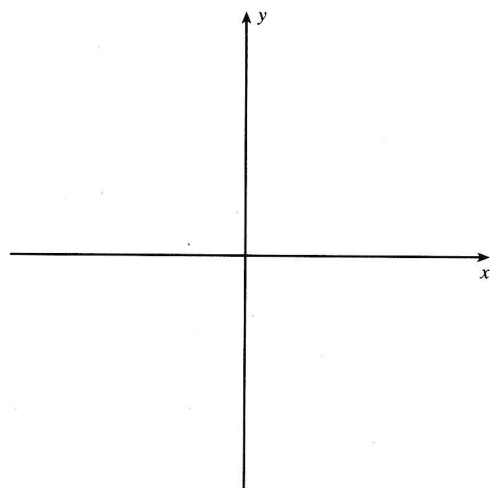
17. Here is a sketch of the graph of $y = x^3$.



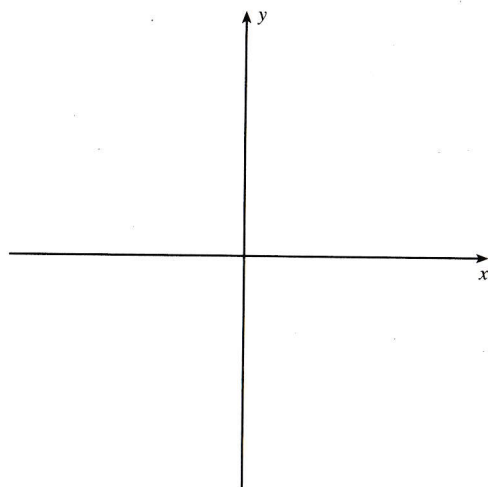
(i) Sketch the graph of $y = x^3 - 2$.



- (ii) Sketch the graph of $y = -x^3$.



- (iii) Sketch the graph of $y = (x + 1)^3$.



[3]

18. A rectangle, $PQRS$, has a perimeter of 38 cm and an area of 80 cm^2 .
The length of side PQ is x centimetres.

- (a) Obtain an expression for QR in terms of x .

.....

 [2]

- (b) Show that x satisfies the equation

$$x^2 - 19x + 80 = 0$$

.....

 [2]

- (c) Solve this equation to find the length and breadth of the rectangle, giving your answers in centimetres correct to two decimal places.

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 [4]

MATHEMATICS

TIER A PAPER 2

A.M. FRIDAY, 15 November 1996

(2½ hours)

Centre Number

Candidate's Name (in full)

Candidate's Examination Number

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3	3	
4	5	
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6	5	
7	2	
8	5	
9	5	
10	3	
11	2	
12	6	
13	7	
14	6	
15	8	
16	4	
17	7	
18	7	
19	4	
20	7	
TOTAL		

1. The grouped frequency distribution of the marks gained by pupils in the first of two mathematics papers is shown in this table.

Marks	Frequency (<i>f</i>)	Mid-point (<i>x</i>)	<i>fx</i>
0 to 9	2		
10 to 19	3		
20 to 29	5		
30 to 39	12		
40 to 49	6		
50 to 59	2		

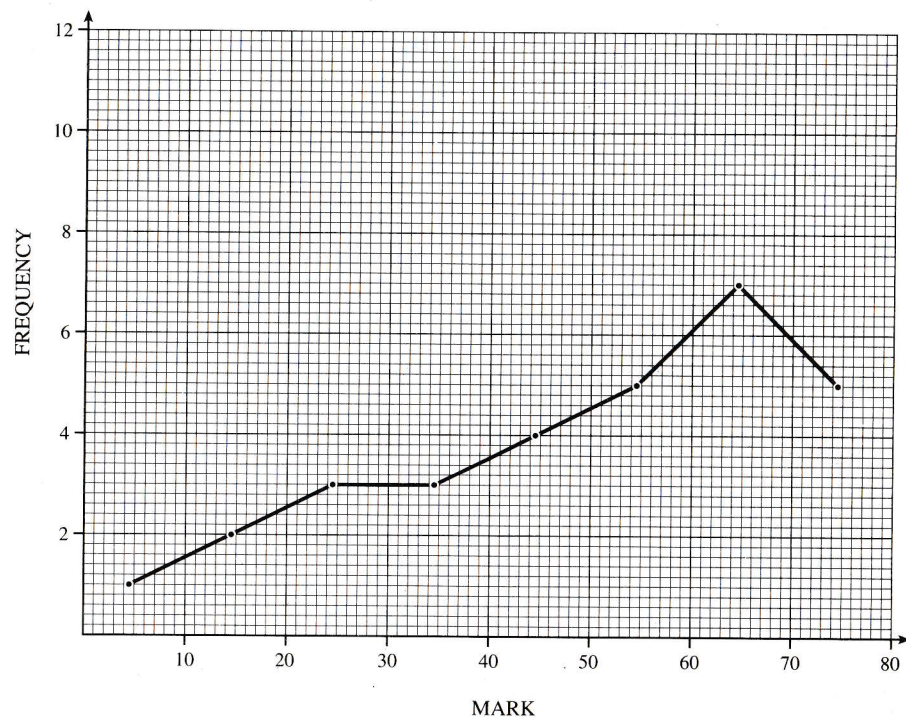
(a) Which is the modal class ? [1]

(b) Complete the mid-point column. [1]

(c) Calculate an estimate of the mean mark per pupil.

..... [3]

(d) The graph at the top of the next page shows a frequency polygon for the distribution of the marks scored by the pupils in the second of the two mathematics papers. On the same grid, draw a frequency polygon to show the distribution of the marks for the first paper.



[2]

(e) Which paper do you think was easier? Give a reason for your answer.

[1]

2. At a church fete, people play a game by spinning an arrow. This table shows the probabilities of the arrow landing on various colours.

Colour	Red	Blue	Green	Yellow
Probability	0.23	0.47	0.18	0.12

(a) The person playing loses if the arrow lands on blue or green. What is the probability that a person playing the game loses?

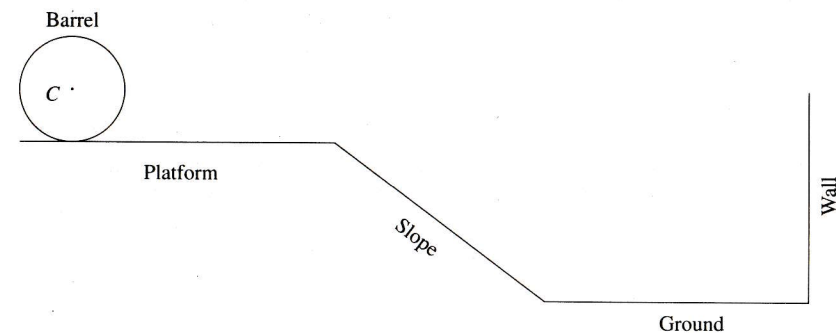
[2]

(b) The person playing wins a top prize if the arrow lands on yellow. If 200 people each play the game once, about how many of them will win a top prize?

[2]

Turn over.

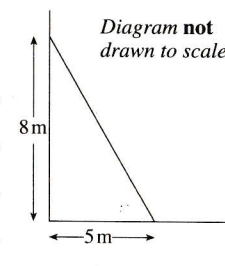
3. A barrel rolls along a platform, down a slope and along the ground until it stops at a wall. This diagram is drawn to scale, and shows the barrel, platform, slope, ground and wall. On the diagram, draw the locus of the centre of the barrel, C .



[3]

4. When the foot of a ladder is on horizontal ground 5 m from the base of a vertical wall, the top of the ladder reaches 8 m up the wall.

(a) How long is the ladder?



[3]

(b) What angle does the ladder make with the horizontal ground?

[2]

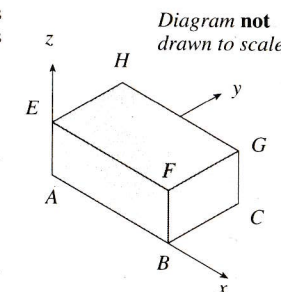
5. A cuboid $ABCDEFGH$ is placed so that A has coordinates $(0, 0, 0)$, B has coordinates $(9, 0, 0)$ and G has coordinates $(9, 7, 5)$.

(a) What is the length of edge BC ?

[1]

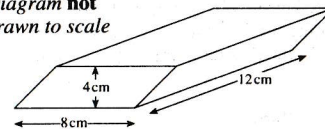
(b) What are the coordinates of vertex H ?

[1]



6. A block of metal is a prism 12 cm long. The cross-section of the prism is a parallelogram with a base 8 cm long and a height of 4 cm.

Diagram not drawn to scale



- (a) Calculate the volume of the block.

[3]

- (b) The block is put into an upright cylinder containing water so that it is completely immersed. The area of cross-section of the cylinder is 60 cm^2 . By how much does the water level rise?

[2]

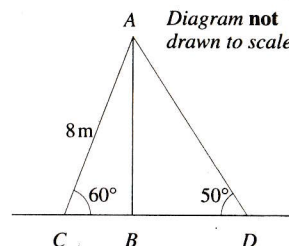
7. A question in Wyn's homework asked him to calculate the probability that a counter drawn from a bag would be green, that a counter drawn from another bag would be green and the probability that both counters would be green. Here is part of Wyn's homework. How can you tell that his homework must be wrong?

Probability the first counter is green =
Probability the second counter is green = 0.3
Probability both counters are green = 0.48

[2]

8. A vertical pole AB is standing on horizontal ground. It is held upright by two wires AC and AD . AC is 8 m long and makes an angle of 60° with the ground. AD makes an angle of 50° with the ground.

Diagram not drawn to scale



- (a) How long is the pole?

[2]

- (b) How long is the wire AD ?

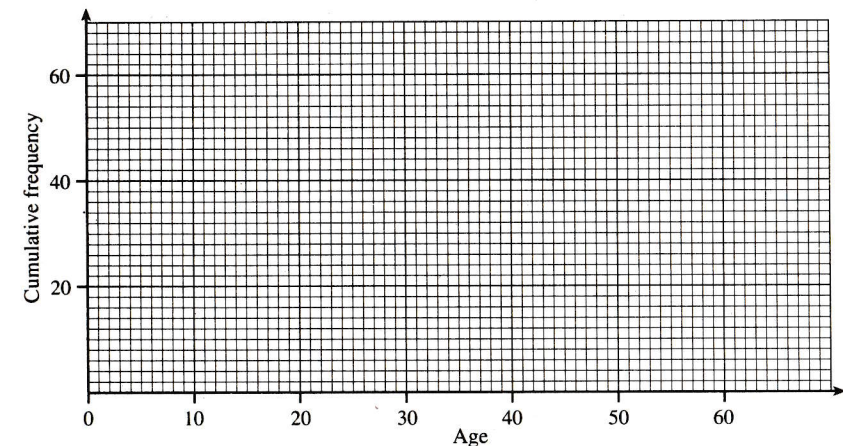
[3]

Turn over

9. This cumulative frequency table shows the cumulative distribution of the ages in years of the passengers on a coach.

Age (years)	Under 10	Under 20	Under 30	Under 40	Under 50	Under 60
Cum. Freq.	5	12	20	30	42	49

- (a) Draw a cumulative frequency diagram to show this information on the grid below.



[3]

- (b) (i) Use your graph to estimate the number of passengers on the coach who are under 45 years old.

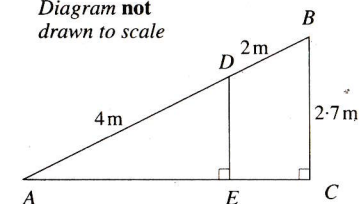
[1]

- (ii) Use your graph to estimate the median age of the passengers on the coach.

[1]

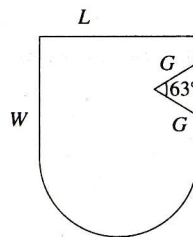
10. This diagram shows a ramp AB , held by a vertical support BC , which is 2.7 m long. A second vertical support DE is placed so that AD is 4 m and DB is 2 m. What is the length of the vertical support DE ?

Diagram not drawn to scale



[3]

11. This diagram shows a piece of land. It is in the form of a rectangle of length L and width W with a semi-circle on one side of the rectangle. There is a triangular piece cut from one of the sides of the rectangle. Two of the sides of the triangle are of length G and the angle between them is 63° . One of the following formulae will give a good approximation for the perimeter of the piece of land. Which formula is it? Give a reason for your answer.

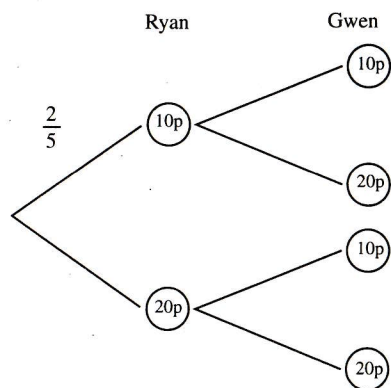


- (i) $P = LW + 1.6L + 2G$ (ii) $P = 2.6L + 2W + G$ (iii) $P = 1.6L(W + G)$ (iv) $P = 1.6LW + G$

[2]

12. Ryan has two 10p coins and three 20p coins. Gwen has four 10p coins and two 20p coins. They each choose one of their coins without looking.

- (a) Complete the probability tree diagram below to show their possible choices.



[3]

- (b) What is the probability that the two chosen coins have a total value of 30p?

[3]

Turn over.

13. The diagram below shows a pencil. The sharpened end forms a cone of height 1.5 cm, the central cylindrical part has diameter 0.8 cm and the other end is hemispherical. The total length of the pencil is 9 cm.

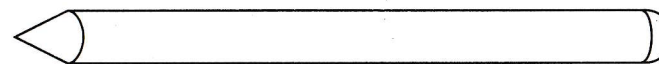
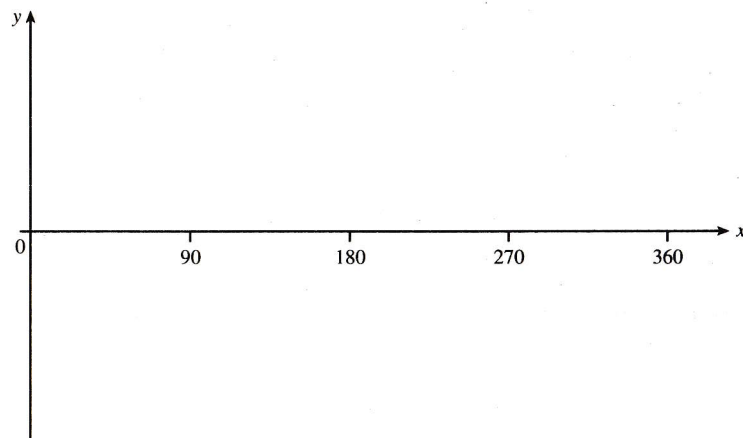


Diagram not drawn to scale

Calculate the total volume of the pencil.

[7]

14. Using the axes given below, sketch the graph of $y = \sin x$ for values of x from 0° to 360° , showing all the important features clearly.



[3]

- (b) Use your calculator together with the sketch to find all the solutions of the following equations in the range 0° to 360° .

(i) $\sin x = 0.8$

.....

.....

.....

(ii) $\sin x = -0.5$

.....

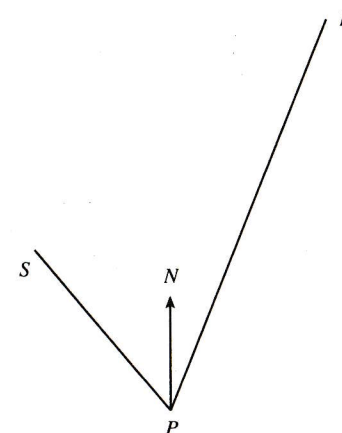
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[3]

Turn over.

15. The diagram below, which is not drawn to scale, shows a port P and two ships R and S . The bearing of R from P is 015° ($N15^\circ E$) and the distance of R from P is 9.4 km. The bearing of S from P is 318° ($N42^\circ W$) and the distance of S from P is 7.2 km.



- (a) Calculate the distance between the two ships.

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[4]

- (b) Calculate the bearing of R from S .

.....

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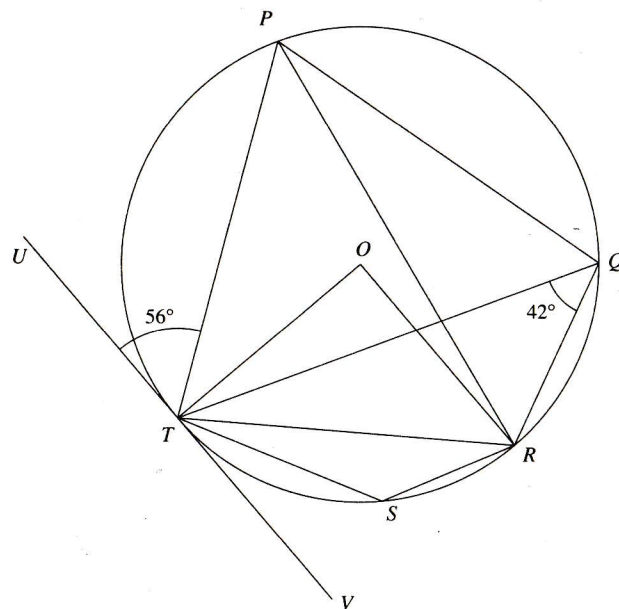
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[4]

16. The diagram below, which is not drawn to scale, shows the points P, Q, R, S and T which lie on the circumference of a circle centre O .

The tangent UV touches the circle at T .

$\widehat{RQT} = 42^\circ$ and $\widehat{PTU} = 56^\circ$.



Find **each** of the following angles.

(i) $\widehat{TPR}$

(ii) $\widehat{TOR}$

(iii) $\widehat{TSR}$

(iv) $\widehat{PQT}$

17. A pack of cards consists of nine cards which are numbered 1, 2, 3, 4, 5, 6, 7, 8 and 9 respectively.

(a) A card with an odd number is drawn from the pack. What is the probability that it is the card numbered 7?

(b) A card with a number less than 6 is drawn from the pack. What is the probability that the number on the card is even?

(c) Two cards are drawn at random one at a time without replacement from the pack.

(i) What is the probability that the number on the first card drawn is 4 and the number on the second card drawn is 1?

(ii) What is the probability that the number on the first card drawn is exactly three more than the number on the second card drawn?

18. Fifty women join a weight watchers class. The grouped frequency distribution of the weights, W kg, of the women when they first joined the class is given below.

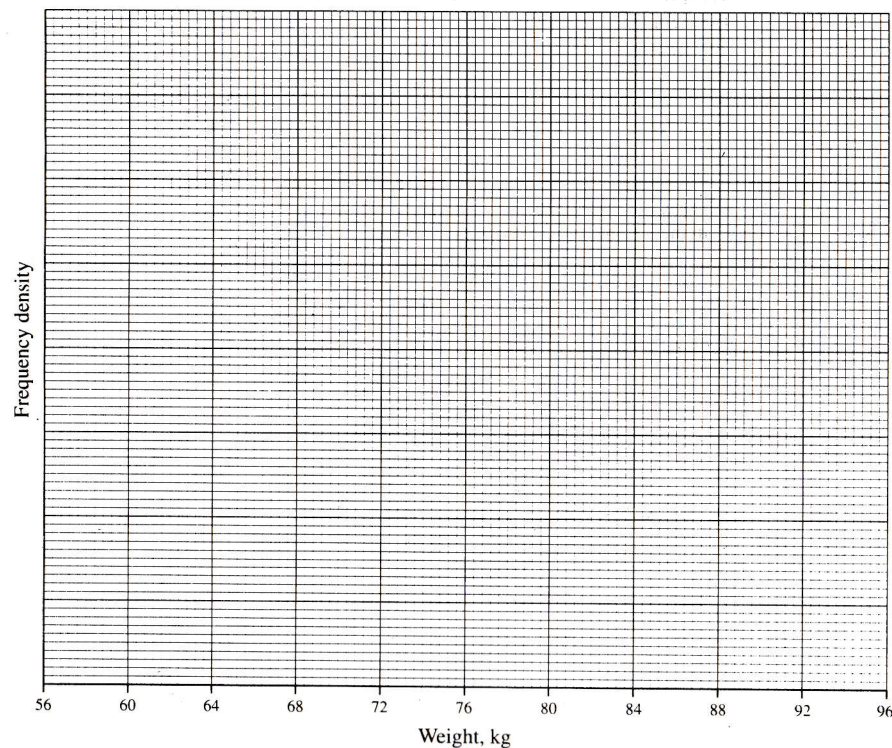
Weight, W kg	Number of women	Frequency density
$60 < W \leq 64$	6	
$64 < W \leq 68$	8	
$68 < W \leq 72$	14	
$72 < W \leq 76$	10	
$76 < W \leq 80$	6	
$80 < W \leq 88$	4	
$88 < W \leq 96$	2	

(a) Complete the above table.

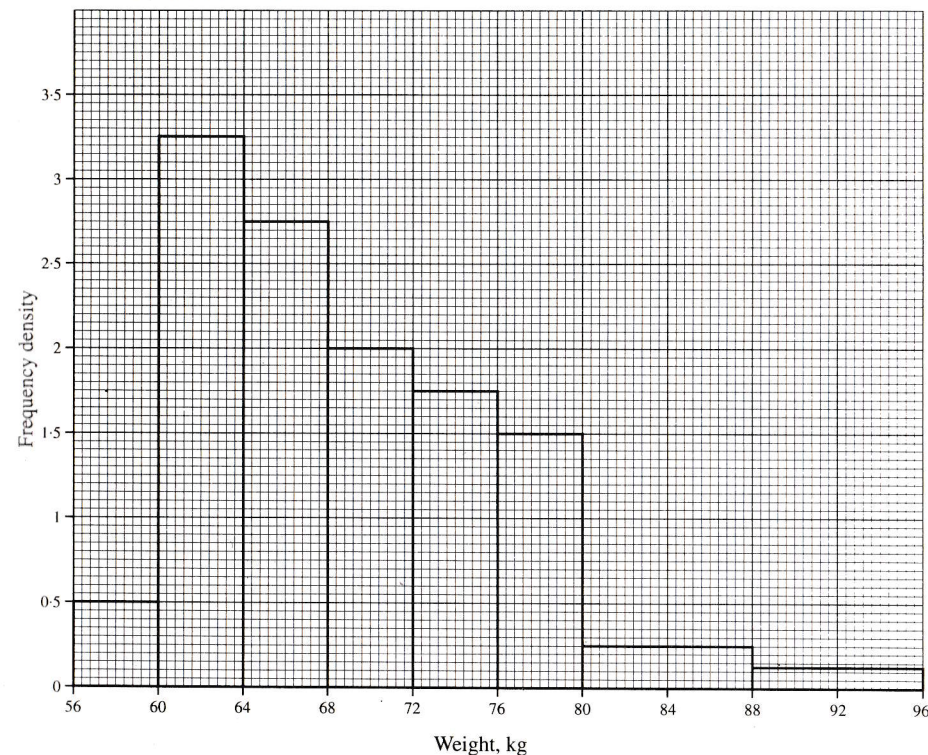
[1]

(b) Draw a histogram to illustrate the above distribution.

[3]



- (c) The histogram below shows the grouped frequency distribution of the weights of the 50 women three months later.



- (i) Use this histogram to estimate the number of women who now weigh more than 70 kg.

- (ii) By comparing the two histograms, describe what has happened to the weights of the women over the three month period.

[3]

Turn over.

19. The frequency distribution below shows a summary of the heights of tomato plants in a greenhouse four weeks after planting.

Height, x cm	Number of tomato plants
6	2
7	3
8	4
9	2
10	1

The mean height of the tomato plants is 7.75 cm. Find the standard deviation of the heights of the tomato plants, giving your answer in centimetres correct to two decimal places.

[4]

20. Griff's school bus is timetabled to arrive at his bus stop at 8.30 am. On any school day, the probability that the bus will arrive after 8.30 is 0.6, the probability that Griff will arrive after 8.30 is 0.25 and the probability that both Griff and the bus will arrive after 8.30 is 0.2. Calculate the probability that, on a particular school day

(a) the bus arrives after 8.30 and Griff arrives before 8.30,

(b) both Griff and the bus arrive before 8.30.

[7]

[7]

MATHEMATICS

TIER A PAPER 3

A.M. TUESDAY, 19 November 1996

(2 hours)

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	14	
2	11	
3	15	
4	10	
TOTAL		

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1. (a) A flower bed of area 29 m^2 is to be dug in a lawn.
- (i) Suggest **three** possible designs for the flower bed. No more than one of your designs should be rectangular. You must show from your working that the area of each design is 29 m^2 .
-
-
- (ii) Given that the lawn is a square of side 8 m, which **one** of your designs would you recommend for use? Give a reason for your choice.
-
-
-
-
-
- (b) A water butt is to be designed to hold $360\,000 \text{ cm}^3$ of rain water. Suggest **three** possible designs for the water butt with capacity between $360\,000 \text{ cm}^3$ and $365\,000 \text{ cm}^3$. You must show your working and recommend **one** of your designs for use, giving a reason for your choice.

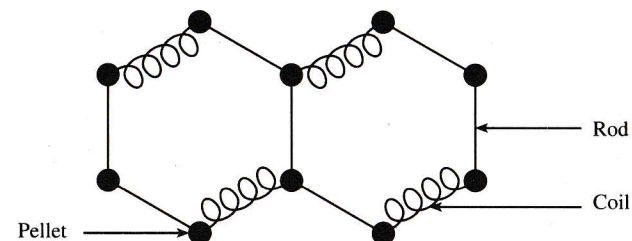
2. (a) A ship sails from a port at P to a dock at D .
The route for the ship's journey is given by the following instructions:

- From the port at P sail North for 8 km.
- Turn East and then sail for 12 km.
- Turn North and then sail for 2 km.
- Finally turn East and then sail the final 4 km to the dock at D .

Find the length of the direct route from the port at P to the dock at D by **two** different methods.

- (b) A tanker sails $N45^\circ E$ (045°) from its berth at B for 12.3 km. It then turns and sails $S45^\circ E$ (135°) to its mooring at M . The direct distance from the berth B to the mooring at M is 13.2 km. Find, by **two** different methods, the total distance sailed by the tanker from its berth to the mooring.

3. Chains are made using pellets, rods and coils. The diagram below shows a two link chain. It has 10 pellets, 7 rods and 4 coils.



- (a) Find the maximum number of complete links you can make from a collection of 585 pellets, 445 rods and 292 coils.

[illegible]

- (b) Explain why it is not possible to have a chain of complete links with the sum of the number of pellets and the number of coils equal to 86 more than the number of rods.

[15]

4. (a) Prove that the height of any equilateral triangle is approximately 866 thousandths of the base.

- (b) Prove that the area of any equilateral triangle is approximately 433 thousandths of the square of the base.

[10]

MATHEMATICS

TIER B PAPER 1

A.M. TUESDAY, 12 November 1996

(2 hours)

Centre Number

Candidate's Name (in full)

Candidate's Examination Number

INSTRUCTIONS TO CANDIDATES

Write your centre number, name and candidate number in the spaces provided above.

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

INFORMATION FOR CANDIDATES

An electronic calculator will be required.

A formula booklet is available and may be used.

You should give details of your method of solution, especially when a calculator is used.

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.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	2	
2	4	
3	3	
4	4	
5	4	
6	2	
7	6	
8	4	
9	2	
10	3	
11	3	
12	3	
13	4	
14	6	
15	4	
16	5	
17	3	
18	5	
19	4	
20	7	
21	5	
22	4	
23	7	
24	3	
25	3	
TOTAL		

1. The distance between two towns is 96 kilometres. One kilometre is approximately $\frac{5}{8}$ of a mile. What is the distance between the two towns in miles ?

.....

.....

.....

[2]

2. A model railway is made to a scale of 1:150.

- (a) The platform of the model railway is 470 mm long. Calculate the real life size of the length of this platform in metres.

.....

.....

.....

[2]

- (b) The height of a real life signal post is 9 m. What is the height, in cm, of the model of this signal post ?

.....

.....

.....

[2]



3. Do not use a calculator when answering this question. All working must be shown.

Alice needs 500 paper cups for a party she is organising. She can only buy the cups in packs of 36. How many packs will she have to buy ?

.....

.....

.....

.....

[3]

4. Everyone who earns at least £61 per week has to pay National Insurance contributions. The weekly amount of contributions to be paid is 2% of the first £61 of weekly pay and 10% of the remainder of the weekly pay. Calculate the weekly National Insurance contributions for a person who earns £151 per week.

.....

.....

.....

.....

[4]

5. Strips of plastic are fastened together using pins, as shown in the diagrams:

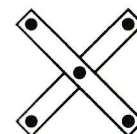


Diagram 1
2 strips
5 pins

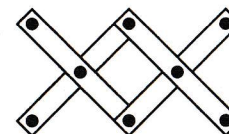


Diagram 2
4 strips
8 pins

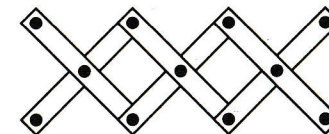


Diagram 3
6 strips
11 pins

- (a) How many strips of plastic would there be in Diagram 10 ?

.....

[1]

- (b) How many strips of plastic would there be in Diagram d ?

.....

[1]

- (c) Heather thinks this is the rule for finding the number of pins in a diagram:

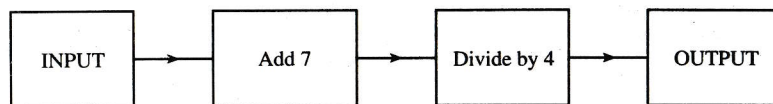
'To find the number of pins you multiply the diagram number by 3 and add 2.'

Using p to stand for the number of pins and d to stand for the diagram number, write down Heather's rule, using algebra, in the form:

$p =$

[2]

6.



Let the number input be n . Write down the output in terms of n .

.....
 [2]

7. John has a pile of 5 pence and 10 pence coins.
 He counts the 10 pence coins and finds that he has x of them.

(a) Write down, in terms of x , the total value of the 10 pence coins.

..... [1]

(b) John has four more 5 pence coins than 10 pence coins. Write down, in terms of x , how many 5 pence coins he has.

..... [1]

(c) Write down, in terms of x , the total value of the 5 pence coins.

..... [1]

(d) Write down, in terms of x , the total value of all the coins that John has. You must simplify your answer as far as possible.

.....

 [3]

8. A builder mixes sand, chippings and cement in the ratio of 3:2:1.

(a) How much sand is there in 300 kg of the mixture?

.....

 [2]

(b) The builder has 180 kg of sand and plenty of cement. How much chippings would he need to make a mixture in the given ratio?

.....

 [2]

X 9. Do not use a calculator when answering this question.
 All working must be shown.

Obtain an ESTIMATE for $\frac{6130}{18 \times 47}$

.....

 [2]

10. Showing all your working, find which of the quantities 55%, 0.6 and $\frac{4}{7}$
 is (i) the smallest, (ii) the largest.

.....

 (i) Smallest = (ii) Largest = [3]

11. Anjum bought some Hi-Fi equipment 2 years ago for £400. Each year the value of the equipment depreciated at the rate of 15% of its value at the beginning of that year. How much is the equipment worth today ?

.....

.....

.....

.....

[3]

12. Solve the equation

$$7(x-2) = 12 + 3x.$$

.....

.....

.....

.....

.....

[3]

13. (a) Write down the next prime number after 43.

.....

[1]

- (b) In the following pattern, write down the next number and explain in words what you think is the rule for finding the next number.

$$\frac{1}{4}, \frac{3}{9}, \frac{5}{16}, \frac{7}{25}, \frac{9}{36}, \frac{11}{49}, \dots$$

.....

.....

.....

.....

[3]

14. The table shows five different temperatures, each measured on the Celsius scale and on the Fahrenheit scale:

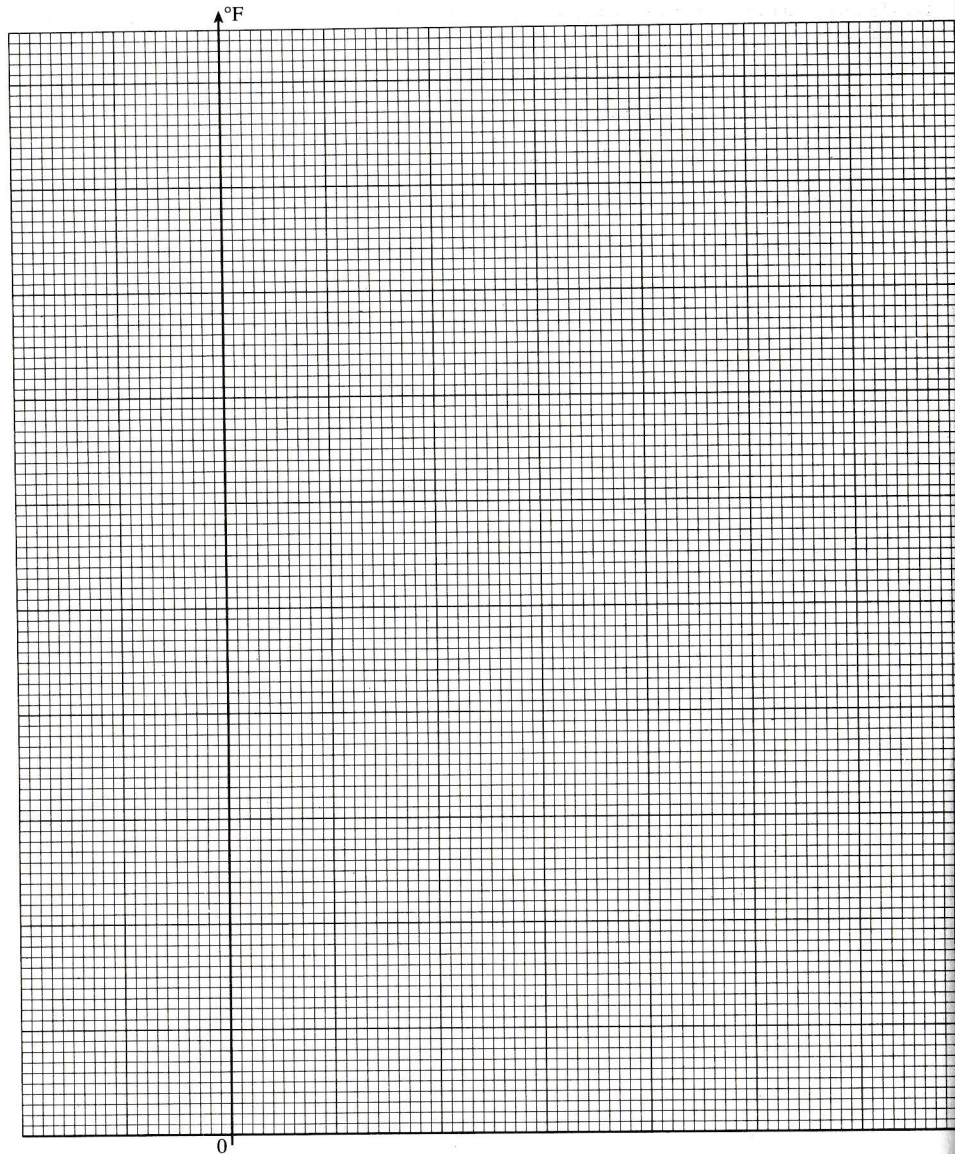
Celsius (°C)	-10	0	10	20	30
Fahrenheit (°F)	14	32	50	68	86

Use the graph paper provided opposite to do the following.

- (a) On the axis marked °C, use a scale of 2 cm to represent 5°C to mark numbers from -10 to 30. [1]
- (b) On the axis marked °F, use a scale of 2 cm to represent 10°F to mark numbers from 0 to 90. [1]
- (c) Plot the points to represent the information given in the table and draw a straight line through your points. [2]

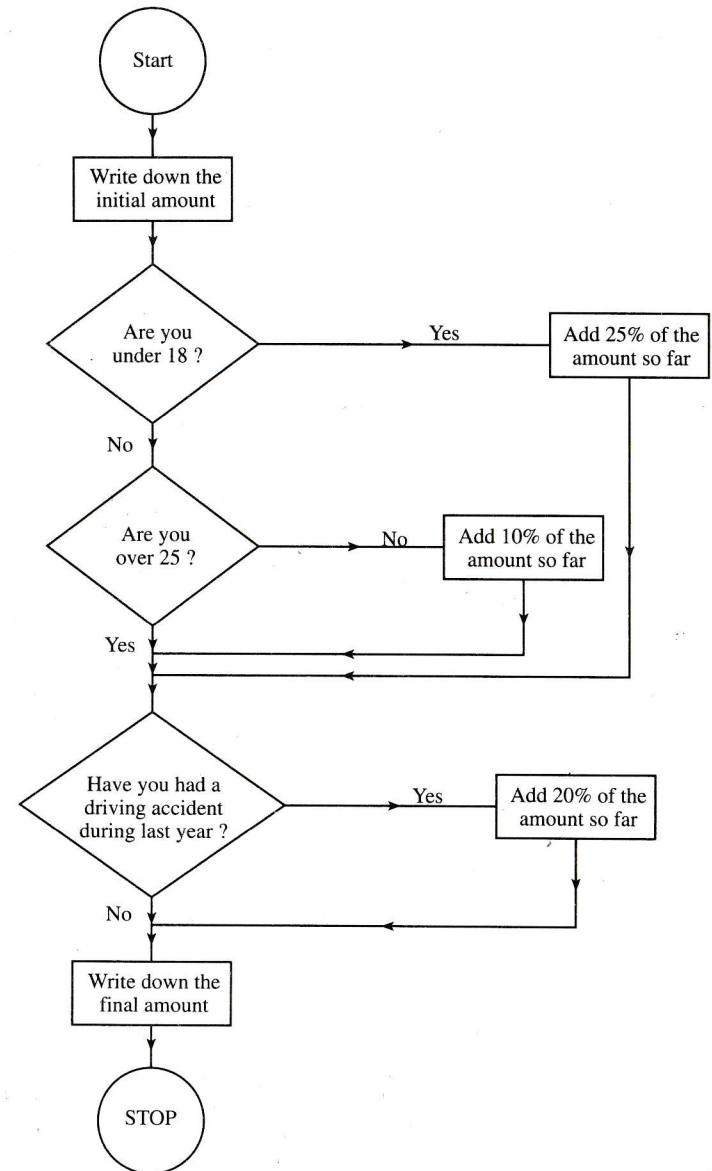
You must show on your graph how you obtain your answers to (d) and (e).

- (d) Use your graph to find what the temperature of 24°C is when measured in °F. [1]
-
- (e) Use your graph to find what the temperature of 20°F is when measured in °C. [1]
-



Turn over.

15. The following flowchart is used to find the amount paid for car insurance. You start with an initial amount and end up with the final amount to be paid.



Using the flowchart write down the details of the calculations of the final amount to be paid if you were the following people.

- (a) Malcolm, aged 17, no accident last year, with an initial amount of £480.

.....

 [2]

- (b) Cliff, aged 24, had an accident last year, with an initial amount of £650.

.....

 [2]

16. Solve the following simultaneous equations by an algebraic (not graphical) method.

$$\begin{aligned} 5x + 3y &= 3 \\ 4x - 2y &= 20 \end{aligned}$$

.....

 [5]

Turn over.



17. Do not use a calculator when answering this question.
 All working must be shown.

Show clearly how you would obtain an ESTIMATE for the following.

$$\frac{\sqrt{97 \cdot 8}}{51 \times 0 \cdot 00187}$$

.....

 [3]

18. (a) Show how you would use your calculator to calculate the value of:

$$\frac{46 \cdot 3 \times 52 \cdot 6}{23 \cdot 1 - 5 \cdot 67}$$

Write each key you would use in a separate box.

Answer = [3]

- (b) Evaluate

$$\frac{(4 \cdot 92)^3}{739 \times 68}$$

Answer = (correct to 2 significant figures) [2]

19. Use the graph paper provided to draw the graph of

$$y = 5 - 2x$$

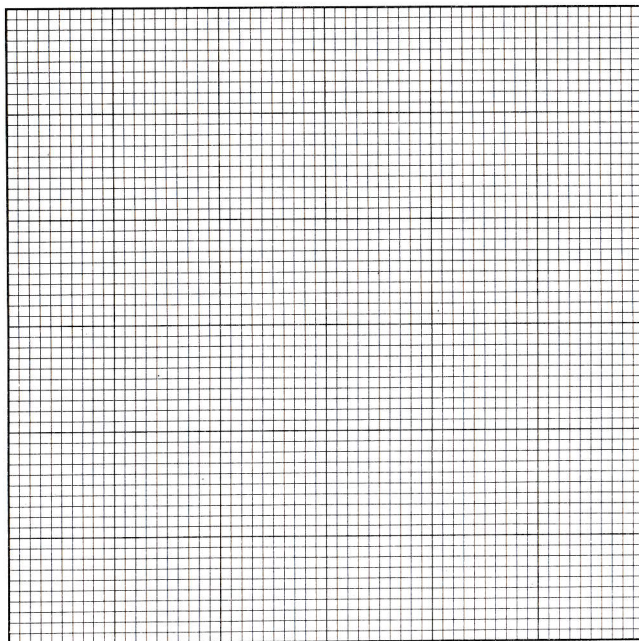
for values of x between $x = 0$ and $x = 5$ inclusive.

.....

.....

.....

.....



[4]

- 20.

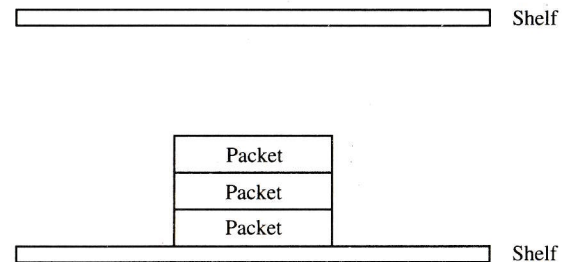


Diagram not drawn to scale

Packets are to be stacked on top of each other on shelves.

- (a) The packets have a height of 66 mm measured to the nearest millimetre. Write down the least and greatest possible values for the height of a packet.

Least = mm Greatest = mm [1]

- (b) Seven of these packets are stacked one on top of the other. Write down the least and greatest possible values for the height of the stack of seven packets.

.....

.....

Least = mm Greatest = mm [2]

- (c) Explain, showing all your calculations, why it is not always possible to stack 7 packets on shelves, which are made 47 cm apart, measured to the nearest cm, but it is always possible to stack 7 packets on shelves, which are made 48 cm apart, measured to the nearest cm.

.....

.....

.....

.....

[4]

21. (a) Write each of the following numbers in standard form.

(i) 0.000083

[1]

(ii) 96 000 000 000

[1]

(b) Find, in standard form, the value of

(i) $(9.45 \times 10^{-7}) \times (6.21 \times 10^3)$,

[1]

(ii) $\frac{(6.21 \times 10^3)}{(9.45 \times 10^{-7})}$

[2]

22. (a) Calculate, in fractional form, the value of

$$a - \frac{1}{2}bc$$

where $a = \frac{2}{3}$, $b = \frac{1}{3}$, and $c = 1\frac{1}{2}$.

[2]

(b) Calculate the value of

$$rs + pt^2$$

when $r = -12$, $s = 5$, $p = 3$ and $t = -4$.

[2]

Turn over.

23. (a) Factorise $3x^2 - 6xy$.

[2]

(b) Expand the following expression, simplifying your answer as far as possible.

$$(3x - 2)(2x + 5)$$

[2]

(c) Make p the subject of the following, simplifying your answer as far as possible.

$$\frac{p}{3} - d = 2(a + d)$$

[3]

24. (a) Rearrange the inequality

$$2 < 3n - 7 \leq 16$$

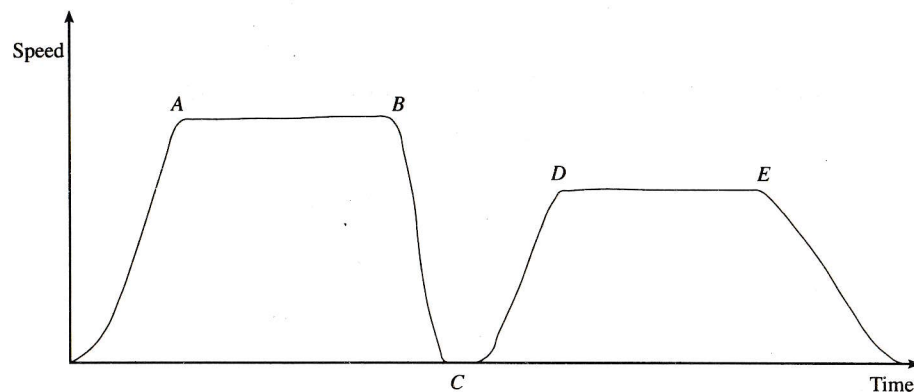
into the form $a < n \leq b$, where a and b are numbers.

[2]

(b) Write down the whole number values of n that satisfy your inequality.

[1]

25. Paul runs in a race. The diagram shown below is the speed-time graph for Paul whilst he was in the race.



- (i) Describe what you think happened to Paul during the period marked *BCD*.

.....

.....

.....

- (ii) What do the parts *AB* and *DE* tell you about Paul's speed?

.....

.....

.....

[3]

MATHEMATICS

TIER B PAPER 2

A.M. FRIDAY, 15 November 1996

(2 hours)

Centre Number

Candidate's Name (in full)

Candidate's Examination Number

INSTRUCTIONS TO CANDIDATES

Write your centre number, name and candidate number in the spaces provided above.

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

INFORMATION FOR CANDIDATES

An electronic calculator will be required.

A formula booklet is available and may be used.

You should give details of your method of solution, especially when a calculator is used.

Unless stated, diagrams are not drawn to scale.

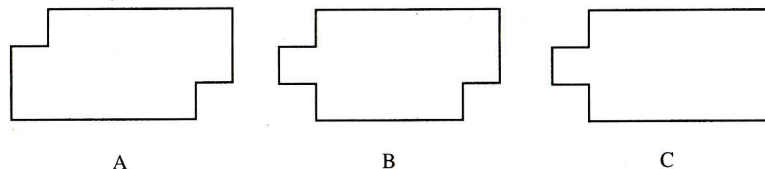
Scale drawing solutions will not be acceptable where you are asked to calculate.

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

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	2	
2	7	
3	4	
4	10	
5	2	
6	3	
7	2	
8	3	
9	4	
10	3	
11	5	
12	2	
13	3	
14	8	
15	4	
16	3	
17	5	
18	2	
19	5	
20	2	
21	5	
22	5	
23	3	
24	2	
25	6	
TOTAL		

1.



These shapes are drawn accurately.

(a) Which of the shapes has one axis of symmetry? [1]

(b) Which of the shapes has rotational symmetry of order 2? [1]

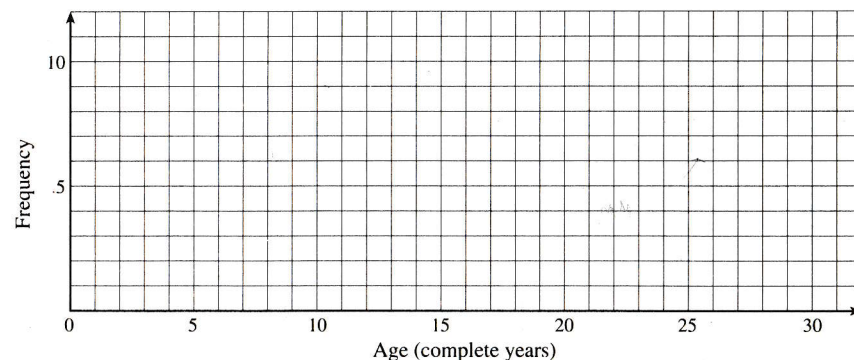
2. There are twenty people in a bowling alley at 2.00 pm on a Wednesday in November. Their ages, in complete years, are given below.

17, 19, 23, 26, 14, 24, 13, 18, 7, 27, 18, 16, 19, 28, 25, 21, 17, 19, 22, 20.

(a) Complete this grouped frequency table to show the distribution of these ages.

Age (years)	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29
Tally					
Frequency					

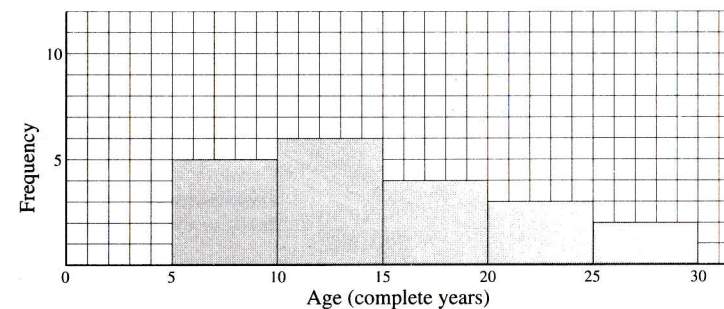
(b) On the grid below, draw a grouped frequency diagram to show the distribution of these ages.



(c) One of these people is chosen at random. What is the probability that this person is less than ten years old?

[1]

(d) This grouped frequency diagram shows the distribution of the ages of the people in the bowling alley at 7.00 pm on the same Wednesday.



(i) How many of the people in the bowling alley at 7.00 pm were under 15 years old?

[1]

(ii) Give a possible reason why there were more people under 15 years old in the bowling alley at 7.00 pm than at 2.00 pm.

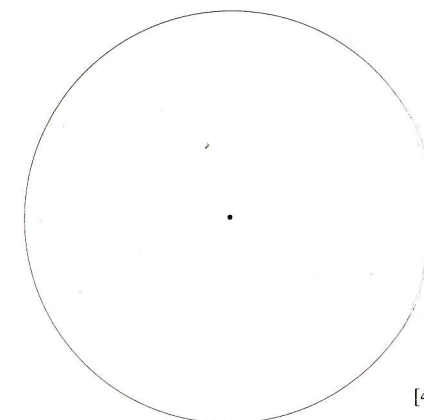
[1]

3. Ricky records the colours of the cars in a car park. Here are his results:

Red 8 Blue 4 Green 5 Yellow 7

In the circle, draw a pie chart to show this information. You must show how you calculate the angles of your pie chart.

The colours of cars.



[4]

4. Figure 1 shows a boat-house which has no floor and is open at one end.

It is 8 m long and 4 m wide.
The side walls are 3 m high.
The top of the roof is 5 m high.

Figure 2 shows a cross-section $PQRST$ of the boat-house.

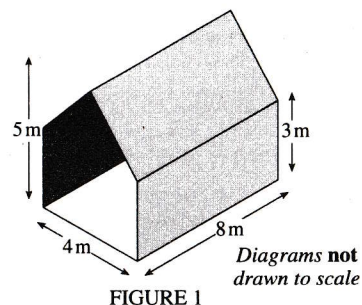


FIGURE 2

- (a) Calculate the area of the closed end of the boat-house.

.....

.....

.....

.....

[3]

- (b) Draw accurately a scale drawing of one end of the boat-house. Use a scale of 2 cm to 1 m.

- (c) Use your scale drawing to find the angle PQR . [1]
- (d) Use your drawing to find the slant height, PQ , of the roof. Give your answer in metres. [1]
- (e) Calculate the total surface area of the walls and roof of the boat-house.

.....

.....

.....

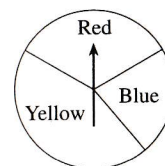
.....

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[2]

- 5.

This diagram is drawn to scale. It shows a fair spinner with 3 sectors coloured red, blue and yellow. Jane says "There are three sectors, so the probability of the spinner landing on yellow is one third." Is she correct? Give a reason for your answer.



.....

.....

[2]

6. The diagram shows the cross-section $ABCDEFGH$ of an early submarine. $ABCH$ is a trapezium. $CDEFGH$ is a regular hexagon. Angle HAB is 110° .

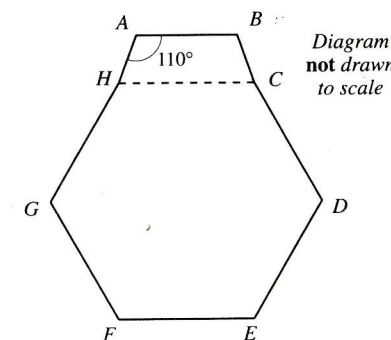
Calculate the size of the reflex angle AHG .

.....

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.....

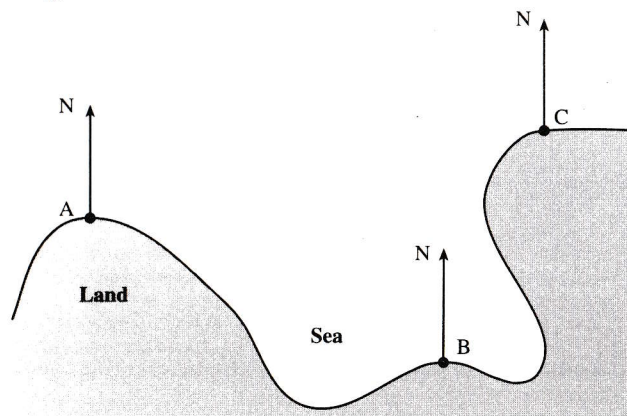


7. A bag contains 5 red beads, 3 black beads and 4 yellow beads. A bead is chosen at random from the bag. What is the probability that the colour of the chosen bead is red?

.....

[2]

8.



This diagram is drawn to scale. It shows three ports A, B and C. The bearing of a ship S from A is 060° (N 60° E). The bearing of the ship S from B is 330° (N 30° W).

- (a) Mark the position of the ship S on the diagram. [2]

- (b) The ship sails directly to port C. On what bearing does the ship sail ?

[1]

9. In this question take $\pi = 3.142$ or use the π button on your calculator.

A roundabout in a playground has a radius of 3 m. It takes 8 seconds to complete one revolution. Jahal is standing on the edge of the roundabout.

- (a) How far does he travel in one revolution ?

[2]

- (b) At what speed is Jahal travelling ? Give your answer in metres per second.

[2]

10. Jenny is conducting a survey into television viewing habits. One of the questions on her questionnaire is:

What is your favourite television programme ?

Neighbours ☐

Grandstand ☐

- (a) What is wrong with the design of this question ?

[1]

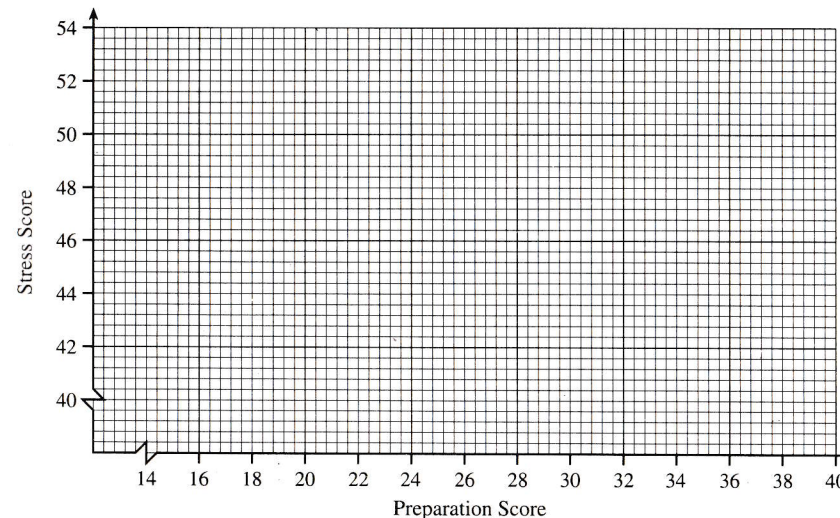
- (b) She carries out her survey by asking all the girls at her Gym Club. Give **two** reasons why her survey is likely to be biased.

[2]

11. Claire has done some research into the amount of preparation people do before a task and the stress they are under when they do it. Each person in her survey is given a preparation score and a stress score. Here are her results.

Preparation score	38	16	23	28	25	28	34	30
Stress score	41	53	48	46	46	48	43	46

- (a) On the grid below, draw a scatter diagram to show these results.



[2]

- (b) Does your diagram show that the two scores are positively correlated, negatively correlated or uncorrelated ?

[1]

- (c) A person undertaking a task has a preparation score of 36. Estimate what his stress score is likely to be ?

[2]

12. The probability that Gareth wins a prize in a raffle is 0.02. What is the probability that Gareth does not win a prize in the raffle ?

[2]

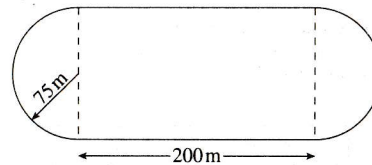
13. In this question take $\pi = 3.142$ or use the π button on your calculator.

This diagram shows a stadium.

The stadium is a rectangle with a semi-circle at each end.

The length of the rectangle is 200 m.

The radius of each semi-circular end is 75 m.



What is the area of the whole stadium ?

.....

.....

.....

.....

[3]

14. The grouped frequency distribution of the marks gained by pupils in the first of two mathematics papers is shown in this table.

Marks	Frequency (f)	Mid-point (x)	fx
0 to 9	2		
10 to 19	3		
20 to 29	5		
30 to 39	12		
40 to 49	6		
50 to 59	2		

- (a) Which is the modal class ? [1]

- (b) Complete the mid-point column. [1]

- (c) Calculate an estimate of the mean mark per pupil.

.....

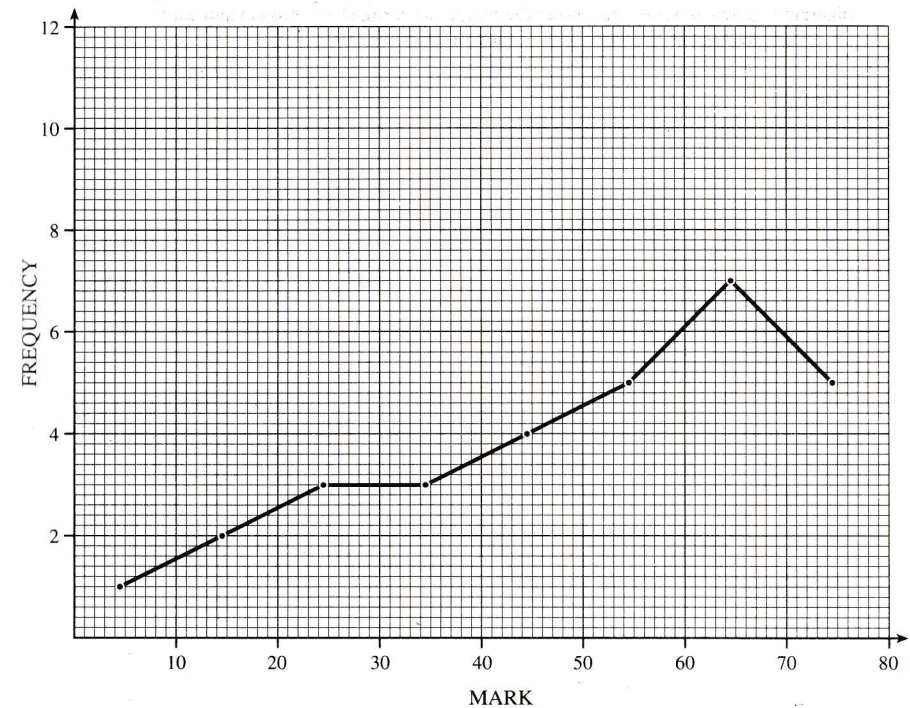
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.....

.....

[3]

- (d) The graph at the top of the next page shows a frequency polygon for the distribution of the marks scored by the pupils in the second of the two mathematics papers. On the same grid, draw a frequency polygon to show the distribution of the marks for the first paper.



[2]

- (e) Which paper do you think was easier ? Give a reason for your answer.

..... [1]

15. At a church fete, people play a game by spinning an arrow. This table shows the probabilities of the arrow landing on various colours.

Colour	Red	Blue	Green	Yellow
Probability	0.23	0.47	0.18	0.12

- (a) The person playing loses if the arrow lands on blue or green. What is the probability that a person playing the game loses ?

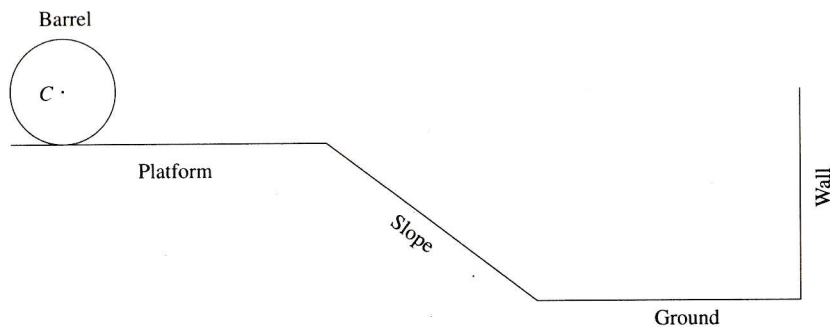
..... [2]

- (b) The person playing wins a top prize if the arrow lands on yellow. If 200 people each play the game once, about how many of them will win a top prize ?

..... [2]

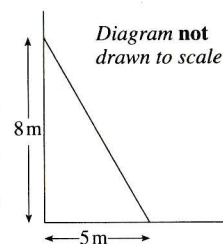
Turn over.

16. A barrel rolls along a platform, down a slope and along the ground until it stops at a wall. This diagram is drawn to scale, and shows the barrel, platform, slope, ground and wall. On the diagram, draw the locus of the centre of the barrel, C.



17. When the foot of a ladder is on horizontal ground 5 m from the base of a vertical wall, the top of the ladder reaches 8 m up the wall.

(a) How long is the ladder?

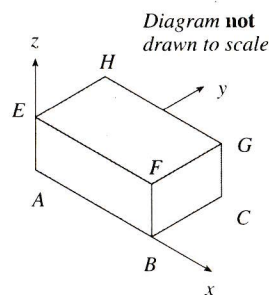


(b) What angle does the ladder make with the horizontal ground?

18. A cuboid $ABCDEFGH$ is placed so that A has coordinates $(0, 0, 0)$, B has coordinates $(9, 0, 0)$ and G has coordinates $(9, 7, 5)$.

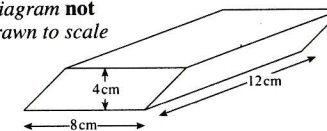
(a) What is the length of edge BC ?

(b) What are the coordinates of vertex H ?



19. A block of metal is a prism 12 cm long. The cross-section of the prism is a parallelogram with a base 8 cm long and a height of 4 cm.

Diagram not drawn to scale



(a) Calculate the volume of the block.

(b) The block is put into an upright cylinder containing water so that it is completely immersed. The area of cross-section of the cylinder is 60 cm^2 . By how much does the water level rise?

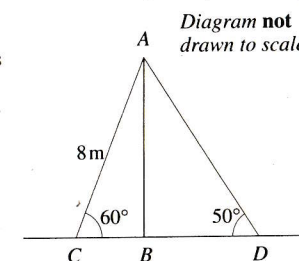
20. A question in Wyn's homework asked him to calculate the probability that a counter drawn from a bag would be green, that a counter drawn from another bag would be green and the probability that both counters would be green. Here is part of Wyn's homework. How can you tell that his homework must be wrong?

Probability the first counter is green =
Probability the second counter is green = 0.3
Probability both counters are green = 0.48

21. A vertical pole AB is standing on horizontal ground. It is held upright by two wires AC and AD . AC is 8 m long and makes an angle of 60° with the ground. AD makes an angle of 50° with the ground.

(a) How long is the pole?

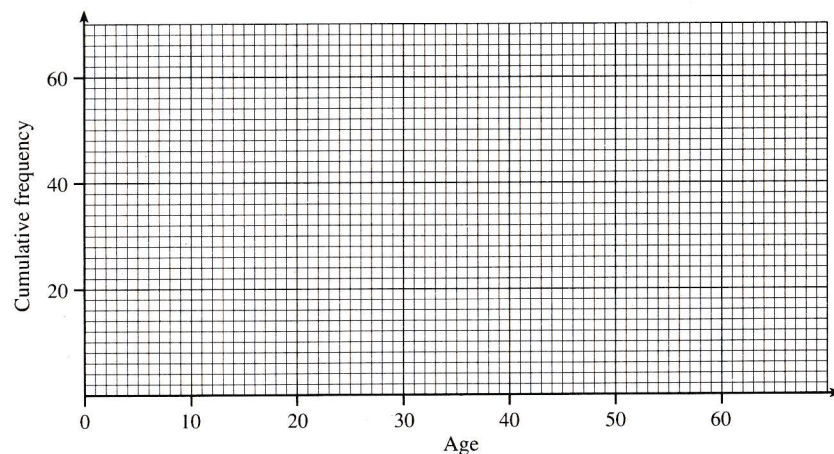
(b) How long is the wire AD ?



22. This **cumulative** frequency table shows the cumulative distribution of the ages in years of the passengers on a coach.

Age (years)	Under 10	Under 20	Under 30	Under 40	Under 50	Under 60
Cum. Freq.	5	12	20	30	42	49

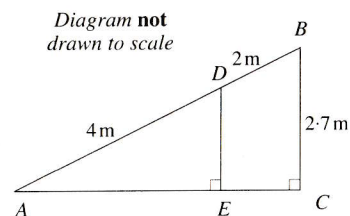
(a) Draw a cumulative frequency diagram to show this information on the grid below.



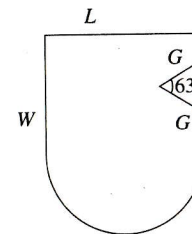
(b) (i) Use your graph to estimate the number of passengers on the coach who are under 45 years old.

(ii) Use your graph to estimate the median age of the passengers on the coach.

23. This diagram shows a ramp AB , held by a vertical support BC , which is 2.7 m long. A second vertical support DE is placed so that AD is 4 m and DB is 2 m. What is the length of the vertical support DE ?



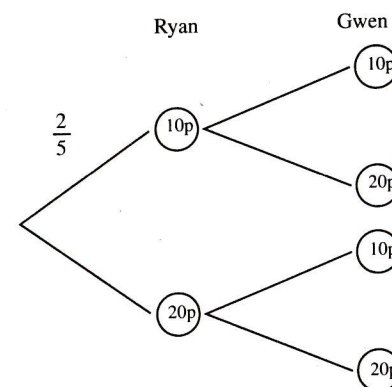
24. This diagram shows a piece of land. It is in the form of a rectangle of length L and width W with a semi-circle on one side of the rectangle. There is a triangular piece cut from one of the sides of the rectangle. Two of the sides of the triangle are of length G and the angle between them is 63° . One of the following formulae will give a good approximation for the perimeter of the piece of land. Which formula is it? Give a reason for your answer.



(i) $P = LW + 1.6L + 2G$ (ii) $P = 2.6L + 2W + G$ (iii) $P = 1.6L(W + G)$ (iv) $P = 1.6LW + G$

25. Ryan has two 10p coins and three 20p coins. Gwen has four 10p coins and two 20p coins. They each choose one of their coins without looking.

(a) Complete the probability tree diagram below to show their possible choices.



(b) What is the probability that the two chosen coins have a total value of 30p?

MATHEMATICS

TIER B PAPER 3

A.M. TUESDAY, 19 November 1996

(2 hours)

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	14	
2	11	
3	14	
4	11	
TOTAL		

Centre Number

Candidate's Name (in full)

Candidate's Examination Number

INSTRUCTIONS TO CANDIDATES

Write your centre number, name and candidate number in the spaces provided above.

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

INFORMATION FOR CANDIDATES

An electronic calculator will be required.

A formula booklet is available and may be used.

You should give details of your method of solution, especially when a calculator is used.

Unless stated, diagrams are not drawn to scale.

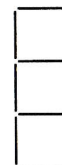
Scale drawing solutions will not be acceptable where you are asked to calculate.

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

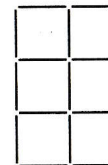
No certificate will be awarded to a candidate detected in any unfair practice during the examination.

1. Look at these patterns.

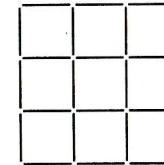
Pattern 1



Pattern 2



Pattern 3



The patterns are made using horizontal lines and vertical lines.

(a) How many **horizontal** lines are needed to make Pattern 200 ?

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(b) How many **horizontal** lines are needed to make Pattern N ? You **must** explain and test your answer.

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(c) How many **vertical** lines are needed to make Pattern 200 ?

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(d) How many **vertical** lines are needed to make Pattern N ? You **must** explain and test your answer.

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(e) Write down the **total** number of lines needed to make Pattern N and test your answer.

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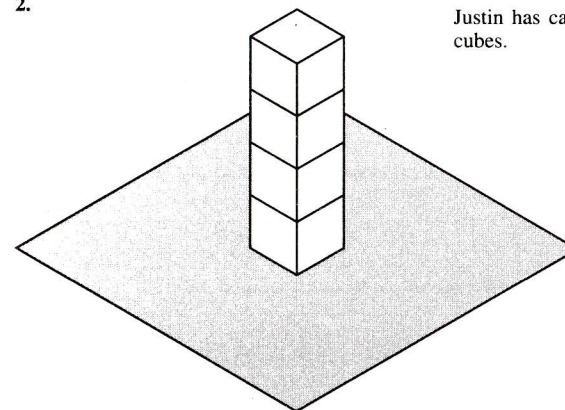
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[14]

Turn over.

2.



Justin has carried out an investigation of towers of cubes.

Here is a copy of his results table.

Number of cubes (c)	Number of faces of the cubes visible (f)
2	9
3	13
4	17
5	21

(a) Find a rule to calculate f , the number of faces visible, when you know c , the number of cubes in the tower.

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(b) Justin finds that a tower with 12 cubes has 49 faces of the cubes visible. Use this extra result to test your rule.

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(c) Give a justification of the rule by explaining why it works.

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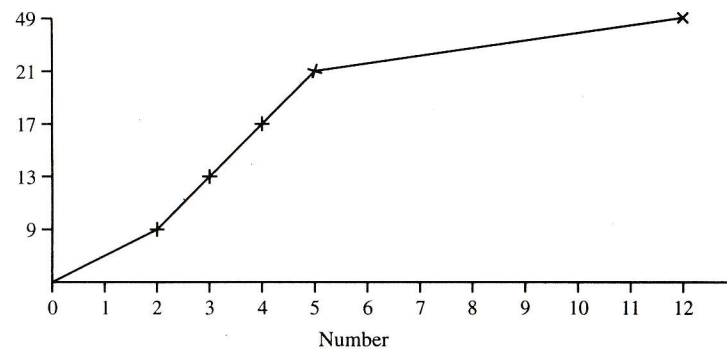
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(d) Justin draws the following graph to illustrate his results.



Justin's presentation of his results is poor.
State three poor features of the diagram.

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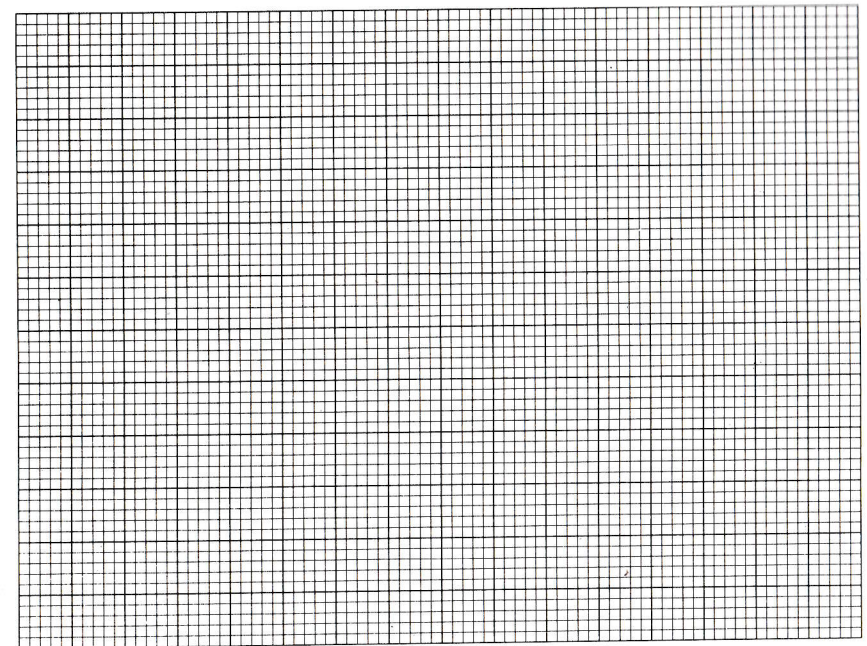
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(e) Draw a graph which improves the display of the information.

Number of cubes (c)	Number of faces of the cubes visible (f)
2	9
3	13
4	17
5	21
12	49



3. (a) A flower bed of area 29 m^2 is to be dug in a lawn.

- (i) Suggest **three** possible designs for the flower bed. No more than one of your designs should be rectangular. You must show from your working that the area of each design is 29 m^2 .

[illegible][illegible]

- (ii) Given that the lawn is a square of side 8 m, which **one** of your designs would you recommend for use ? Give a reason for your choice.

(The following text is extremely faint and largely illegible due to low contrast and resolution. It appears to be a multi-paragraph document or report.)

- (b) A water butt is to be designed to hold 360000 cm^3 of rain water. Suggest **three** possible designs for the water butt with capacity between 360000 cm^3 and 365000 cm^3 . You must show your working and recommend **one** of your designs for use, giving a reason for your choice.

This image shows a single sheet of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

4. (a) A ship sails from a port at P to a dock at D .
The route for the ship's journey is given by the following instructions:
- From the port at P sail North for 8 km.
 - Turn East and then sail for 12 km.
 - Turn North and then sail for 2 km.
 - Finally turn East and then sail the final 4 km to the dock at D .

Find the length of the direct route from the port at P to the dock at D by **two** different methods.

- (b) A tanker sails N45°E (045°) from its berth at B for 12.3 km. It then turns and sails S45°E (135°) to its mooring at M . The direct distance from the berth B to the mooring at M is 13.2 km. Find, by **two** different methods, the total distance sailed by the tanker from its berth to the mooring.

GCSE MATHEMATICS NOVEMBER NUMERICAL ANSWERS 1996

Tier A

Paper 1

- 1 $x = 3, y = -4$
 3 (a) 139.72347 (b) 2.4×10^{-3}
 5 (a) Least 65.5, Greatest = 66.5 (b) Least 458.5, Greatest 465.5
 6 (a) 600 (b) 858
 7 (a)(i) 8.3×10^{-5} (ii) 9.6×10^{10} (b)(i) 5.86845×10^{-3} (ii) 6.571428×10^9
 8 (a) 5/12 (b) -12
 9 (a) $3x(x - 2y)$ (b) $6x^2 + 11x - 10$ (c) $3(2a + 3d)$
 10 (a) $3 < n \leq 7\frac{2}{3}$ (b) 4, 5, 6, 7
 13 (a)(i) 156.75, 131.75 (ii) 12.75 (b) 129.375
 14 (a) 15.25614 (b) 40°
 15 (a) $E = kx^2$ (b) 30 (c) $E = 30x^2$ (d) 907.5 Joules
 16 (a) 2 (c) -2.3, 1.3
 18 (a) $19 - x$ (c) $12.7 \text{ cm} \times 6.3 \text{ cm}$

Paper 2

- 1 (a) 30 to 39 (b) 4.5, 14.5, 24.5, etc.
 (c) 32.16 (e) Paper 2
 2 (a) 0.65 (b) 24
 4 (a) 9.43 m (b) 58°
 5 (a) 7 units (b) (0, 7, 5)
 6 (a) 384 cm^3 (b) 6.4 cm
 8 (a) 6.928 m (b) 9.044 m
 9 (b)(i) 36 (ii) 34.5
 10 1.8 m
 11 (ii)
 12 (b) 16/30
 13 3.95 cm^3
 14 (b) 53° and 127°, 210° and 330°
 15 (a) 8.15 km (b) N63°E
 16 (i) 42° (ii) 84° (iii) 138° (iv) 56°
 17 (a) 1/5 (b) 2/5 (c)(i) 1/72 (ii) 6/72
 18 (a) 1.5, 2, 3.5, 2.5, 1.5, 0.5, 0.25 (c)(i) 20
 19 1.16 cm
 20 (a) 0.4 (b) 0.35

GCSE MATHEMATICS NOVEMBER NUMERICAL ANSWERS 1996

Tier B

Paper 1

- 1 60 miles
- 2 70.5 m (b) 6 cm
- 3 14
- 4 £10.22
- 5 (a) 20 (b) $2d$ (c) $3d + 2$
- 6 $(n + 7)/4$
- 7 (a) $10x$ (b) $x + 4$ (c) $5(x + 4)$ (d) $15x + 20$
- 8 (a) 150 kg (b) 120 kg
- 10 (i) smallest = 55% (ii) largest = 0.6
- 11 289
- 12 6.5
- 13 (a) 47 (b) $13/64$
- 14 (d) 75.2 (e) -6.67
- 15 (a) 600 (b) 858
- 16 $x = 3, y = -4$
- 18 (a) 139.72347 (b) 2.4×10^{-3}
- 20 (a) Least 65.5, Greatest = 66.5 (b) Least 458.5, Greatest 465.5
- 21 (a)(i) 8.3×10^{-5} (ii) 9.6×10^{10} (b)(i) 5.86845×10^{-3} (ii) 6.571428×10^9
- 22 (a) $5/12$ (b) -12
- 23 (a) $3x(x - 2y)$ (b) $6x^2 + 11x - 10$ (c) $3(2a + 3d)$
- 24 (a) $3 < n \leq 7\frac{2}{3}$ (b) 4, 5, 6, 7

Paper 2

- 1 (a) C (b) A
- 2 (a) 1, 2, 8, 5, 4 (c) $1/20$ (d)(i) 11
- 4 (a) 16 m^2 (c) $90^\circ \pm 2^\circ$ (d) $2.8 \text{ m} \pm 0.1 \text{ m}$ (e) 108.8 m^2
- 5 Not true
- 6 190°
- 7 $5/12$
- 8 (b) $S85^\circ E$
- 9 (a) 18.8495 m (b) 2.3 m/s
- 12 0.98
- 13 47671.4 m^2
- 14 (a) 30 to 39 (b) 4.5, 14.5, 24.5, etc. (c) 32.16 (e) Paper 2
- 15 (a) 0.65 (b) 24
- 17 (a) 9.43 m (b) 58°
- 18 (a) 7 units (b) (0, 7, 5)
- 19 (a) 384 cm^3 (b) 6.4 cm
- 21 (a) 6.928 m (b) 9.044 m
- 22 (b)(i) 36 (ii) 34.5
- 23 1.8 m
- 24 (ii) 25 (b) 16/30

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