

O LEVEL MATHEMATICS SPECIMEN PAPER 1

Paper 1

2 hours

Candidates answer on the Question Paper.

Additional Materials: Geometrical Instruments
Electronic Calculator

READ THESE INSTRUCTIONS FIRST

Answer **all** the questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answer in degree to one decimal place.

For π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

At the end of the examination, fasten all your work securely together.

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

The total of the marks for this paper is 80.



80

Answer **all** the questions.

1. (a) Expand $(x - 1)(3x + 1)$ and simplify your answer.

Answer _____ [1]

- (b) Factorise $6x^3 - 27x^2 - 15x$ completely.

Answer _____ [1]

2. During a sale, all items in a store are given 15% discount.
A bag costs \$110.50 during the sale.
Find the original price of the bag before the sale.

Answer \$ _____ [2]

3. It takes 14 builders to construct a house in 20 days.
Given that all the builders work at the same rate, find the number of builders required to construct the house in 7 days.

Answer _____ [2]

4. Simplify $36x^3y^2 \div \frac{24y^3}{x^{-2}}$.

Answer _____ [2]

5. Written as a product of its prime factors, $4116 = 2^2 \times 3 \times 7^x$.

(a) Find the value of x .

Answer $x =$ _____ [1]

(b) Hence, find the smallest integer k such that $\frac{4116}{k}$ is a perfect square.

Answer Smallest $k =$ _____ [1]

6. On a particular day in Japan, the lowest temperature is -13°C and the highest temperature is 7°C .

(a) Find the temperature range on that day.

Answer _____ $^\circ\text{C}$ [1]

(b) Taking one day to be 24 hours, find the average rate of temperature change in terms of $^\circ\text{C}/\text{h}$ for that day.

Answer _____ $^\circ\text{C}/\text{h}$ [1]

7. The first five terms of a sequence is 2, 7, 12, 17, ...

(a) Find a formula for the n th term.

Answer n th term = _____ [1]

(b) Which term in the sequence is equal to 117?

Answer _____th term [1]

8. The scale of a map is 1 : 35 000.

(a) The actual length of a road is 24.5 km. Find the length of the road on the map in cm.

Answer _____ cm [2]

(b) The area of a reservoir on the map is 1200 mm². Find the actual area of the reservoir in m².

Answer _____ m² [2]

9. Find the compound interest on \$7200 at an interest rate of 3.6% per annum for 4 years. Give your answer to the nearest dollar.

Answer \$ _____ [2]

10. (a) Express 0.032 cubic metres in millilitres.

Answer _____ ml [1]

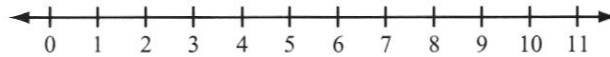
- (b) 290 grams is subtracted from 0.71 kilograms. Leave your answer in grams.

Answer _____ g [1]

11. (a) Find the smallest integer a for which $5 + \frac{1}{3}(4a - 7) > 6$.

Answer _____ [2]

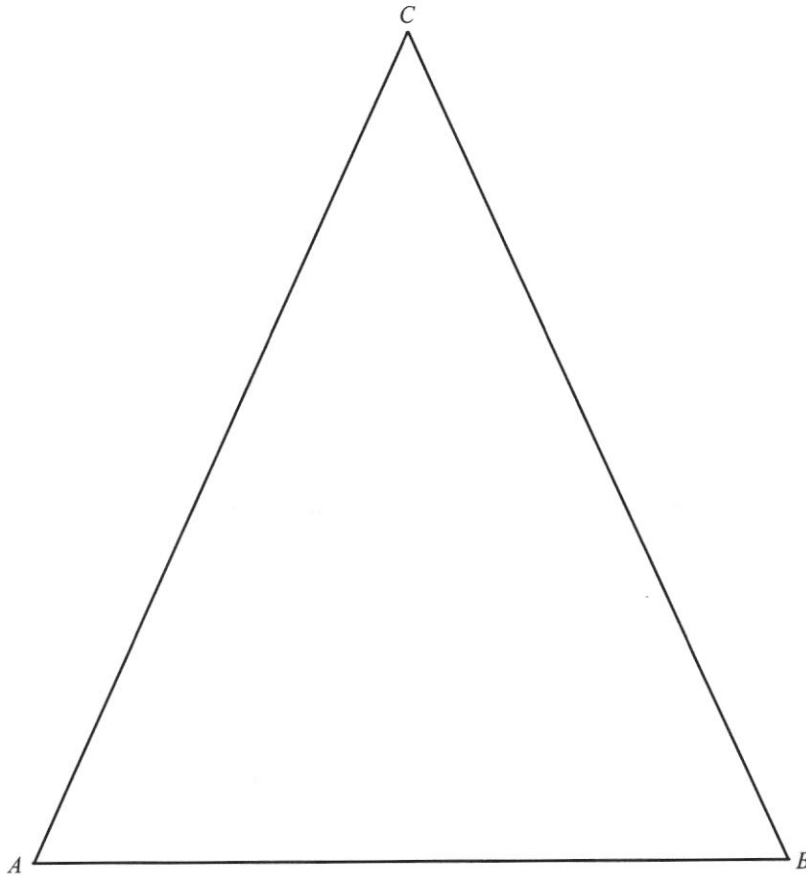
- (b) Represent the solution set of the inequality in (a) on the number line provided. [1]



12. Solve $84 = 27x - 3x^2$.

Answer $x =$ _____ or _____ [3]

13. In the diagram below, $\triangle ABC$ is a field and point X is a point on the field equidistant from points A and B . X is also closer to AB than to BC . Find a possible location for point X . [3]



14. A fair 6-sided die and two unbiased coins are tossed together. Find the probability that

(a) a prime number and two heads are obtained,

Answer _____ [1]

(b) the coins show different faces regardless of the number on the die,

Answer _____ [1]

(c) a multiple of 7 and two tails are obtained.

Answer _____ [1]

15. The length of one side of the base of two similar pyramids X and Y are 7 cm and 5 cm respectively.

(a) If the height of pyramid X is 28 cm, find the height of pyramid Y .

Answer _____ cm [1]

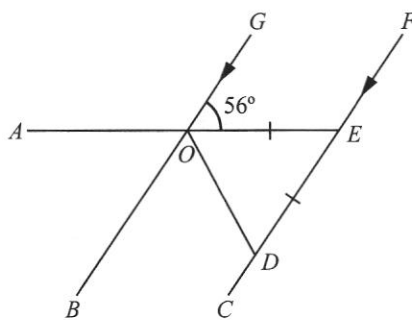
(b) If the base area of pyramid Y is 100 cm^2 , find the base area of pyramid X .

Answer _____ cm^2 [2]

(c) The volume of another similar pyramid Z is 8 times the volume of pyramid Y . Find the length of the corresponding side of the base of pyramid Z .

Answer _____ cm [2]

16.



Given that AOE and $CDEF$ are straight lines with $GB \parallel FC$ and $\angle EOG = 56^\circ$, $OE = ED$, find the value of

(a) $\angle DOE$,

Answer $\angle DOE =$ _____ [1]

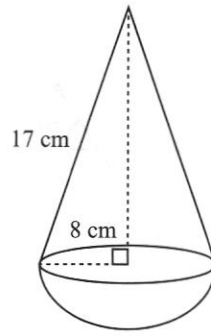
(b) $\angle AOB$,

Answer $\angle AOB =$ _____ [1]

(c) $\angle CDO$.

Answer $\angle CDO =$ _____ [1]

17.



In the figure above, the solid comprises a hemisphere and cone which are glued together. Both the hemisphere and the cone have the same radius of 8 cm and the slant height of the cone is 17 cm. Calculate

(a) the height of the cone,

Answer _____ cm [1]

(b) the total external surface area of the solid, giving your answer correct to two decimal places.

Answer _____ cm² [3]

18. In a test, every student in a group scores 6 to 10 marks. The number of students scoring each mark is shown in the table below.

Marks	6	7	8	9	10
Number of students	2	6	8	x	1

- (a) If the mode is 8, write down the range of values for x .

Answer _____ [1]

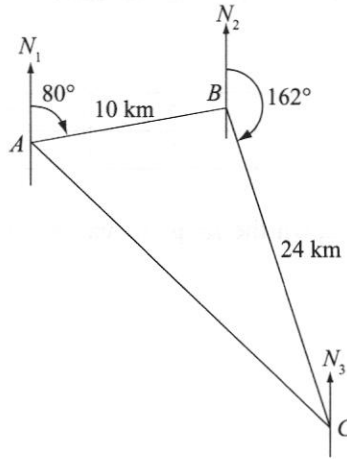
- (b) If the median mark is 9, write down the smallest value of x .

Answer $x =$ _____ [2]

- (c) Find the value of x , if the mean mark is 7.75.

Answer $x =$ _____ [2]

19.



In the diagram, the bearing of B from A is 080° , and the bearing of C from B is 162° . It is also given that $AB = 10$ km and $BC = 24$ km. Calculate

(a) $\angle ABC$,

Answer $\angle ABC =$ _____ [2]

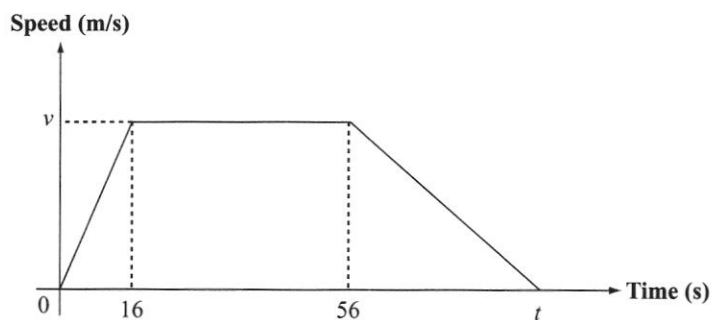
(b) the distance of AC ,

Answer _____ km [2]

(c) the bearing of A from C .

Answer _____ $^\circ$ [2]

20. The diagram shows the speed-time graph of a particle which accelerated uniformly from rest at a rate of 3.5 m/s^2 for 16 seconds to reach a speed of $v \text{ m/s}$. The particle then continues at this speed for 40 seconds before slowing down. It comes to a stop at time t seconds.



Given that the rate of acceleration is twice the rate of deceleration, calculate

- (a) the value of v ,

Answer $v =$ _____ [2]

- (b) the total distance travelled by the particle,

Answer _____ m [2]

- (c) the time taken by the particle to cover a distance of 2.408 km.

Answer _____ s [2]

21. It is given that $\mathbf{a} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 0.5 \\ 2 \end{pmatrix}$, $\mathbf{c} = \begin{pmatrix} 6 \\ p \end{pmatrix}$ and $\mathbf{d} = \begin{pmatrix} q \\ 1 \end{pmatrix}$.

(a) Express $\mathbf{a} - 3\mathbf{b}$ as a column vector.

Answer _____ [1]

(b) Given that \mathbf{a} is parallel to \mathbf{c} , find the value of p .

Answer $p =$ _____ [1]

(c) Given that the $|\mathbf{d}| = 10$ units. Find possible values of q .

Answer $q =$ _____ or _____ [2]

22. A factory produces cartons of bottles of milk in three flavours and delivers them to three different stores. The number of cartons of milk supplied in each delivery, the cost per carton, and the number of deliveries made to each store in December are shown in the table below.

Flavour of milk		Number of cartons in each delivery			Number of deliveries in December
		Original	Strawberry	Chocolate	
Name of store	<i>P</i>	30	45	60	<i>x</i>
	<i>Q</i>	25	30	75	<i>y</i>
	<i>R</i>	80	55	45	<i>z</i>
Cost price per carton		$\$a$	$\$b$	$\$c$	

- (a) Write down two matrices such that the elements of their product, under matrix multiplication, will represent the total number of cartons of each flavour delivered in December.

Answer _____ [1]

- (b) Explain briefly what the following matrix product represents.

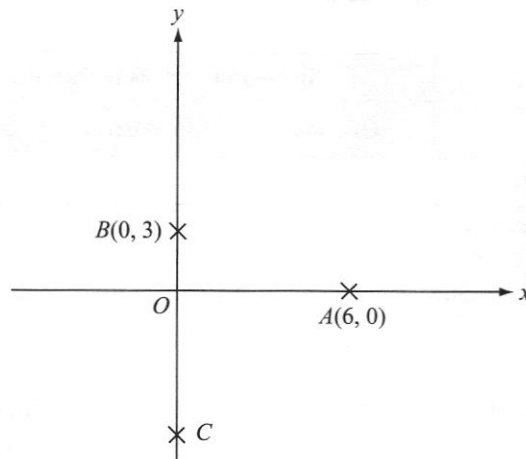
$$\begin{pmatrix} 30 & 45 & 60 \\ 25 & 30 & 75 \\ 80 & 55 & 45 \end{pmatrix} \begin{pmatrix} a \\ b \\ c \end{pmatrix}$$

Answer _____ [2]

- (c) Write down a product of three matrices that will give the total cost of delivery in December.

Answer _____ [3]

23. In the diagram, A is the point $(6, 0)$, B is the point $(0, 3)$ and C is a point on the y -axis. The area of triangle AOB is half that of triangle AOC .



- (a) Calculate the gradient of the line passing through A and B .

Answer _____ [1]

- (b) Find the coordinates of point C .

Answer _____ [1]

- (c) Find the equation of the line passing through A and C .

Answer _____ [2]

- (d) Let C' be the point of reflection of C in the x -axis. State the size of $\angle CAC'$ and hence sketch the smallest circle that passes through A , C and C' on the diagram.

Answer $\angle CAC' =$ _____ $^\circ$ [3]

O LEVEL MATHEMATICS SPECIMEN PAPER 1

Paper 2

$2\frac{1}{2}$ hours

Candidates answer on the Answer Paper/Answer Booklet.

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Electronic Calculator

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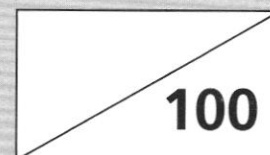
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At the end of the examination, fasten all your work securely together.

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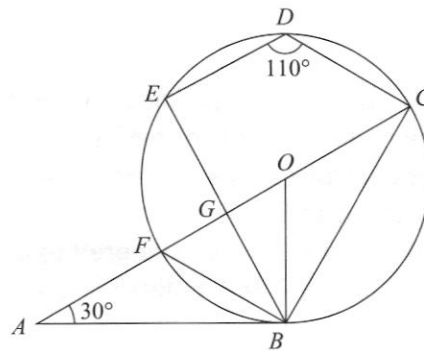
The total of the marks for this paper is 100.



1. (a) Factorise completely $75x^2 - 3y^4$. [2]
- (b) Express as a single fraction in its simplest form $\frac{2}{x-1} - \frac{3}{2x+1}$. [2]
- (c) Solve $\frac{3}{x-3} = 2x - 1$. [3]

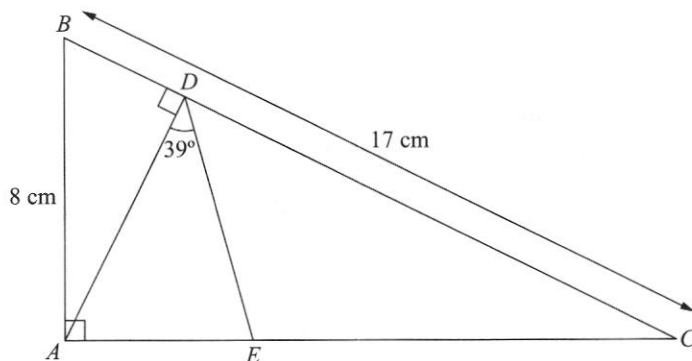
2. A cylindrical cake has a thickness of 5 cm and density of 0.8 g/cm³.
 - (a) 10% of its mass is lost during the baking process. Given that the final mass of the cake is 1.8 kg, calculate the mass of the cake before it is baked. [2]
 - (b) The cake is then cut into 5 equal slices, shaped as a sector. Find
 - (i) the volume, in cm³, of each slice of cake, [2]
 - (ii) the total surface area, in cm², of each slice of cake. [4]

3. In the diagram, O is the centre of the circle, $AFOC$ and EGB are straight lines and AB is a tangent to the circle.



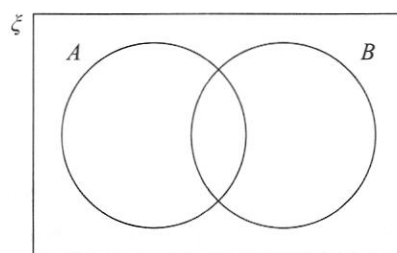
- (a) Given that $\angle BAC = 30^\circ$ and $\angle EDC = 110^\circ$, calculate
 - (i) $\angle AOB$, [1]
 - (ii) $\angle FCB$, [1]
 - (iii) $\angle EBC$, [1]
 - (iv) $\angle EGC$. [1]
- (b) Explain why $\triangle ABO$ is similar to $\triangle CBF$. [1]

4. In the diagram, $BC = 17$ cm, $AB = 8$ cm, $\angle ADE = 39^\circ$, $\angle BAC = 90^\circ$ and D is the foot of perpendicular from A to BC .



Calculate

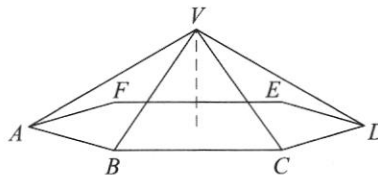
- (a) the exact value of $\sin \angle ABC$, [2]
 (b) the length of AD , [2]
 (c) $\angle DAC$, [2]
 (d) the length of AE , [2]
 (e) Find $\frac{\text{area of } \triangle BAD}{\text{area of } \triangle BCA}$. [2]
5. (a) Copy the Venn diagram and insert a largest possible set C such that $A \cap C = C$ and $B \cap C = \phi$. [1]



- (b) If ξ denotes the set of all positive integers less than 50, A denotes the set of all positive integers less than 50 that are multiples of 3, and B denotes the set of all positive integers less than 50 that are multiples of 5,
- (i) state the main property of the elements of set $A \cap B$ and find $n(A \cap B)$, [2]
 (ii) suggest what set C in (a) could represent and list down all the element(s) contained in C , [2]
 (iii) shade on the diagram the set $A \cap C'$. [1]
- (c) Draw a new Venn diagram of the three sets X , Y and Z such that $X \cap Y \neq \phi$ and $(X \cup Y) \subset Z$. [3]

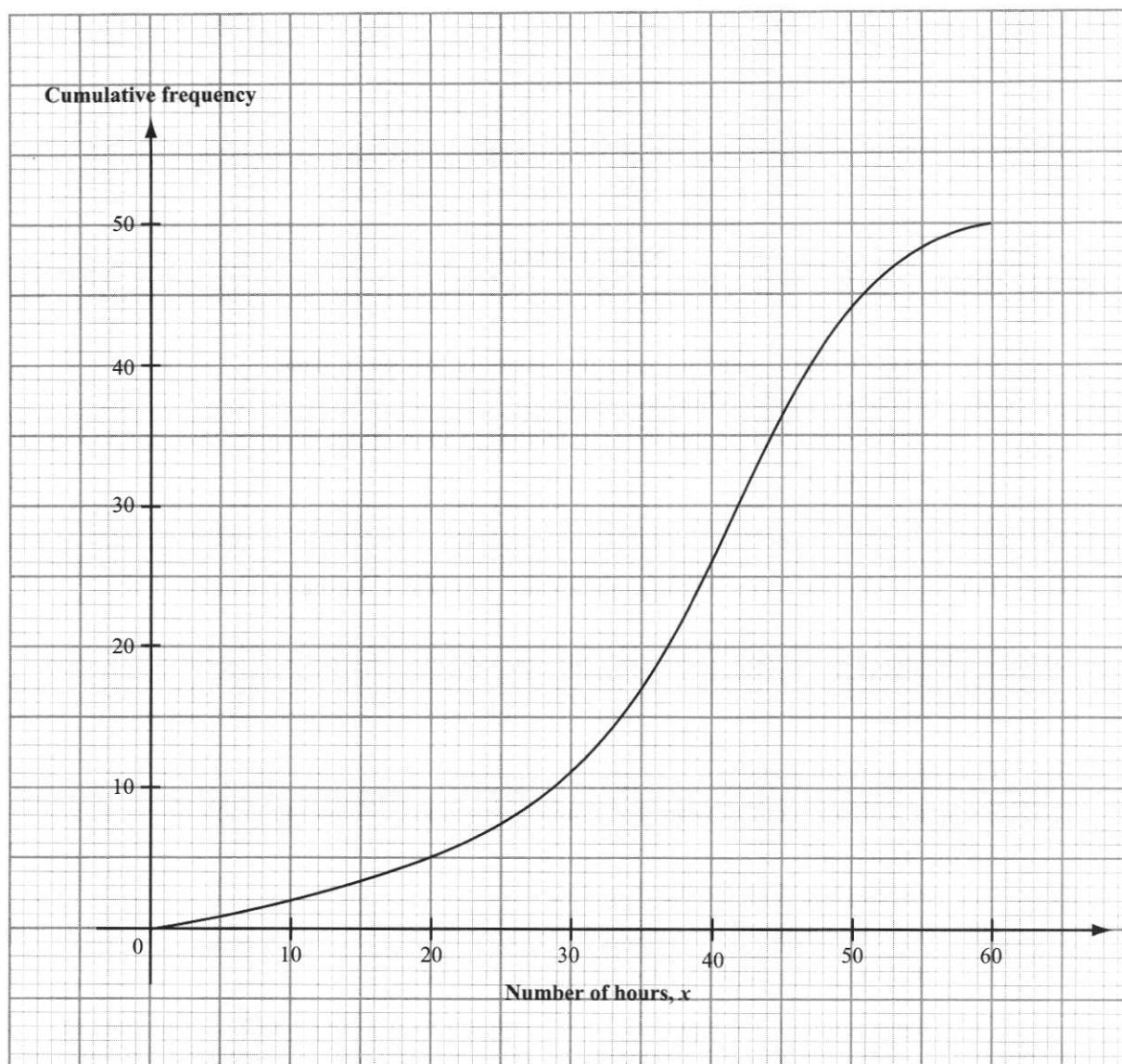
6. The point A is $(3, 2)$ and the point B is such that the gradient of the line AB is 2.
- Find the equation of the line AB . [2]
 - If B lies on the x -axis, find the coordinates of B . [1]
 - It is given that \overrightarrow{AC} is $\begin{pmatrix} -2 \\ 1 \end{pmatrix}$.
 - Calculate $|\overrightarrow{AC}|$. [1]
 - Find the coordinates of C . [2]
 - Find the coordinates of D such that $ABCD$ is a parallelogram. [1]
 - The position vector of point E is $\begin{pmatrix} 4 \\ 4 \end{pmatrix}$. Write down two facts about A , B and E . [3]
7. Sally has 5 red and 2 black blouses, and 10 skirts of which 4 are black and 6 are brown, in her wardrobe. Every morning, she will select a blouse and a skirt for work at random.
- Draw a relevant probability tree diagram. [2]
 - Calculate the probability that Sally will select a blouse and a skirt of the same colour. [2]
 - Calculate the probability that she will select a blouse and a skirt of different colour. [1]
 - Calculate the probability that she will wear a red blouse and a brown skirt. [2]
 - One day, Sally went shopping. Assuming that she will only be buying red blouses, calculate the number of red blouses she needs to buy so that the probability of selecting a black blouse and brown skirt from her wardrobe is reduced to 0.08. [3]

8. The diagram shows a right pyramid with a horizontal regular hexagonal base $ABCDEF$ and vertex V .



- Find the size of each interior angle of the hexagonal base. [2]
- The volume of the pyramid is $45\sqrt{3}$ cm³ and the area of the base is $54\sqrt{3}$ cm².
 - Calculate the height of the pyramid. [2]
 - Find the length of each side of the hexagonal base. [3]
 - Calculate, in cm², the total surface area of the pyramid, giving your answer correct to three decimal places. [4]

9. The number of hours spent by a group of 50 people in company *A* doing exercise in the month of September is shown in the cumulative frequency graph.



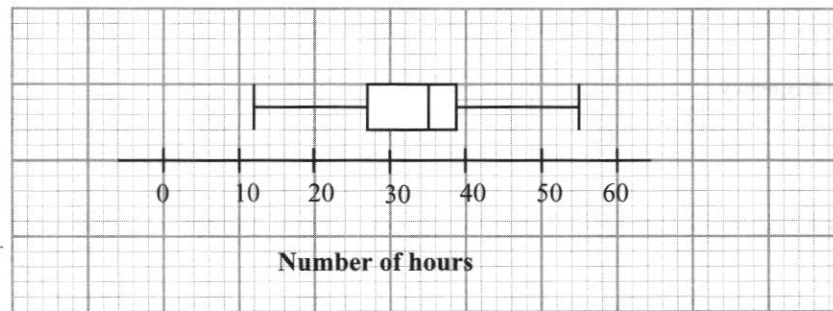
- (a) Copy and complete the grouped frequency table of number of hours of exercise of each employee.

Number of hours, x	$0 \leq x \leq 10$	$10 < x \leq 20$	$20 < x \leq 30$	$30 < x \leq 40$	$40 < x \leq 50$	$50 < x \leq 60$
Frequency						

[2]

- (b) Estimate the median number of hours and the interquartile range. [3]
- (c) Estimate the fraction of the total number of people spending 47 hours or more doing exercise. [2]

- (d) The box-and-whisker diagram below illustrates the number of hours spent on doing exercise by another group of 50 employees from company *B*.



- (i) Find the median and interquartile range for this set of data. [3]
- (ii) Comment on the following claim:
 'Employees from company *A* spend more time doing exercise than employees from company *B*.' [1]
10. The following table give some corresponding value of x and y for the graph of $y = 2x + \frac{1}{x} - 5$.

x	0.2	0.5	1	1.5	2	2.5	3	4
y	0.4	p	-2	-1.3	q	0.4	1.3	3.25

- (a) Find the value of p and q . [2]
- (b) Using a scale of 2 cm to represent 1 unit on both axes, draw the graph of $y = 2x + \frac{1}{x} - 5$ for $0.2 \leq x \leq 4$. [3]
- (c) Use your graph to find, for $0.2 \leq x \leq 4$,
- the coordinates of the minimum point, [1]
 - the range of values of x for which y is at least 2, [1]
 - the solution of the equation $3x + \frac{1}{x} - 6 = 0$ by drawing a suitable straight line. [2]
11. Alex wants to buy a new laptop on hire purchase at a cash price of \$1450. There are three methods of payment:

Plan *A*: 2-year loan from a financial institution which charges at a compound interest of 7.5% per annum and pay monthly instalments.

Plan *B*: 2-year bank loan which charges at a simple interest rate of 8% per annum and pay monthly instalments.

Plan *C*: Pay a deposit of 5% and pay the balance amount over the next 18 months at a simple interest rate of 9% per annum.

- (a) Alex has a budget of \$75 per month for monthly instalments. He is willing to pay a deposit of at most \$100. By calculating the monthly instalments of each plan, which plan should Alex choose? [6]
- (b) Which plan is the least costly overall? Show your working clearly. [4]