



**MATHEMATICAL STUDIES
 STANDARD LEVEL
 PAPER 1**

Wednesday 3 May 2000 (afternoon)

1 hour

Name

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Number

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INSTRUCTIONS TO CANDIDATES

- Write your name and candidate number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all the questions in the spaces provided.
- Unless otherwise stated in the question, all numerical answers must be given exactly or to three significant figures, as appropriate.
- Write the make and model of your calculator in the box below *e.g.* Casio *fx-7400G*, Sharp EL-9400, Texas Instruments TI-80.

Calculator

Make	Model

EXAMINER	TEAM LEADER	IBCA
TOTAL /60	TOTAL /60	TOTAL /60

Maximum marks will be given for correct answers. Where an answer is wrong, some marks may be given for a correct method provided this is shown by written working. Working may be continued below the box, if necessary. (If graphs from a graphic display calculator are being used to find solutions, you should sketch these graphs as part of your answer.)

1. Let $m = 6.0 \times 10^3$ and $n = 2.4 \times 10^{-5}$.

Express each of the following in the form $a \times 10^k$, where $1 \leq a < 10$ and $k \in \mathbb{Z}$.

(a) mn ;

(b) $\frac{m}{n}$.

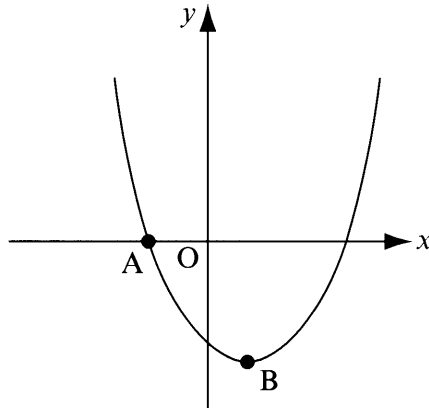
Working:

Answers:

(a) _____

(b) _____

2. The diagram shows the graph of $y = x^2 - 2x - 8$. The graph crosses the x -axis at the point A, and has a vertex at B.



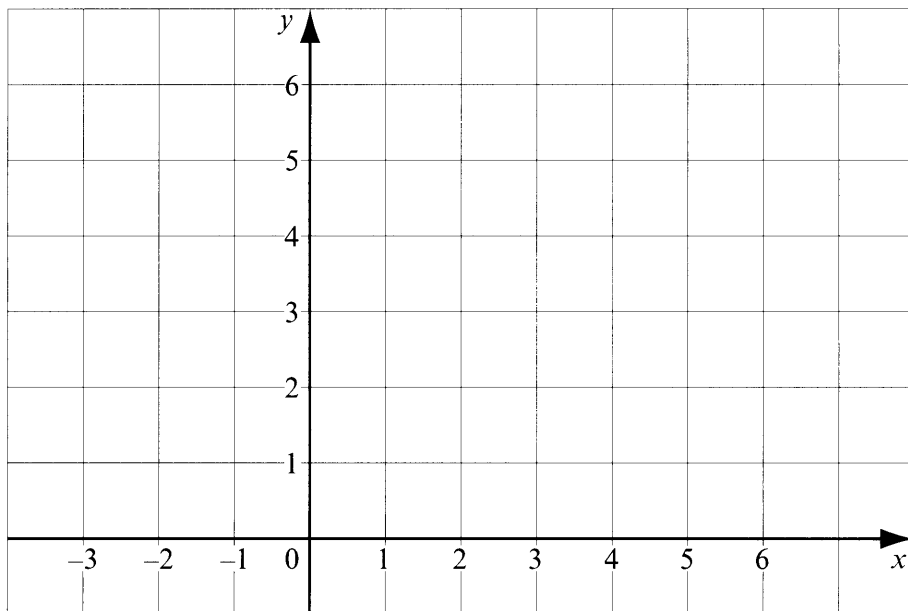
- (a) Factorise $x^2 - 2x - 8$.
- (b) Write down the coordinates of each of these points
- (i) A ;
- (ii) B .

Working:

Answers:

- (a) _____
- (b) (i) _____
- (ii) _____

3. \vec{OA} is the vector $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and \vec{OB} is the vector $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$.



- (a) On the grid
- (i) draw and label **directed** line segments for the vectors \vec{OA} and \vec{OB} ;
 - (ii) draw the vector \vec{AB} .
- (b) Write the vector \vec{AB} in the form $\begin{pmatrix} x \\ y \end{pmatrix}$.

Working:

Answer:

(b) _____

4. Consider the following statements:

- p : Good mathematics students go to good universities
- q : Good music students are good mathematics students
- r : Students who go to good universities get good jobs

(a) From these statements, write two **valid** conclusions.

(b) Write in words each of the following

(i) $\neg q$;

(ii) $p \wedge r$.

Working:

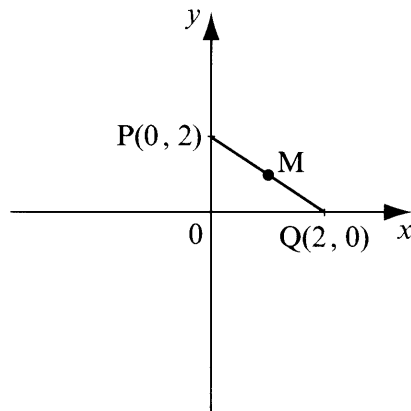
Answers:

(a) _____

(b) (i) _____

(ii) _____

5. The following diagram shows the points P, Q and M. M is the midpoint of [PQ].



- (a) Write down the equation of the line (PQ) .
- (b) Write down the equation of the line through M which is perpendicular to the line (PQ) .

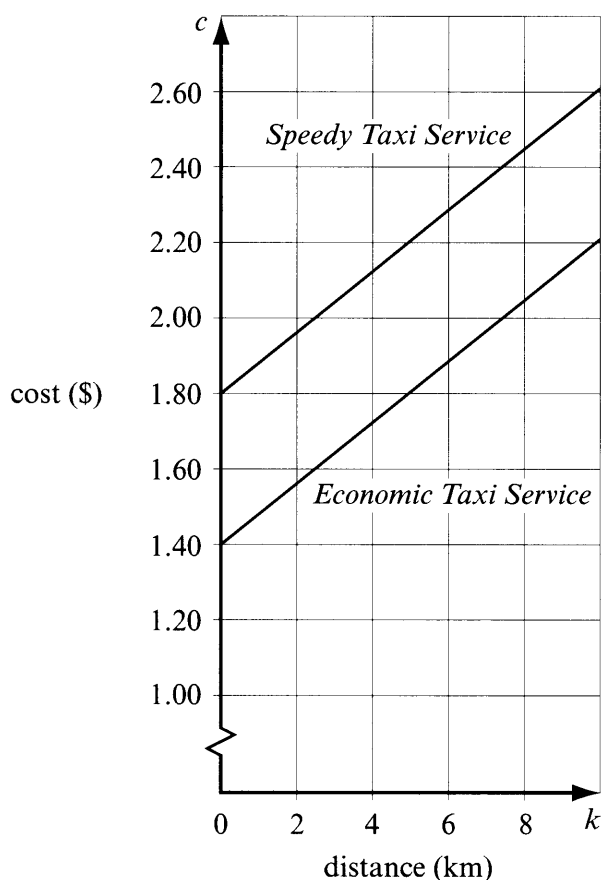
Working:

Answers:

(a) _____

(b) _____

6. The costs charged by two taxi services are represented by the two parallel lines on the following graph. The *Speedy Taxi Service* charges \$ 1.80, plus 10 cents for each kilometre.



- (a) Write an equation for the cost, c , in \$, of using the *Economic Taxi Service* for any number of kilometres, k .
- (b) Bruce uses the *Economic Taxi Service*.
- (i) How much will he pay for travelling 7 km ?
- (ii) How far can he travel for \$ 2.40 ?

Working:

Answers:

(a) _____

(b) (i) _____

(ii) _____

7. The population of Bangor is growing each year. At the end of 1996, the population was 40 000. At the end of 1998, the population was 44 100. Assuming that these annual figures follow a geometric progression, calculate
- (a) the population of Bangor at the end of 1997 ;
 - (b) the population of Bangor at the end of 1992 .

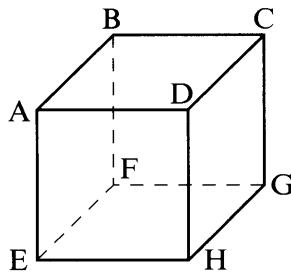
Working:

Answers:

(a) _____

(b) _____

8. The following diagram shows a carton in the shape of a cube 8 cm long on each side:



- (a) The longest rod that will fit on the bottom of the carton would go from E to G. Find the length l of this rod.
- (b) Find the length L of the longest rod that would fit inside the carton.

Working:

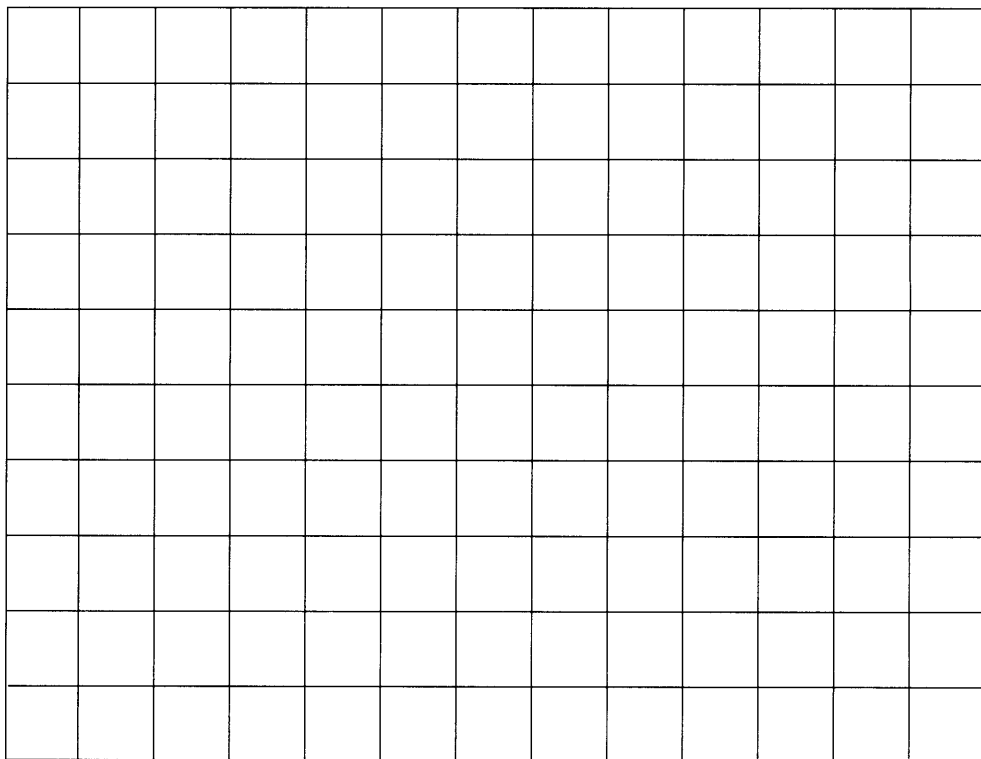
Answers:

- (a) _____
- (b) _____

9. The following table shows the age distribution of teachers who smoke at *Laughlin High School*.

Ages	Number of smokers
$20 \leq x < 30$	5
$30 \leq x < 40$	4
$40 \leq x < 50$	3
$50 \leq x < 60$	2
$60 \leq x < 70$	3

- (a) Calculate an estimate of the mean smoking age.
- (b) On the following grid, construct a histogram to represent this data.

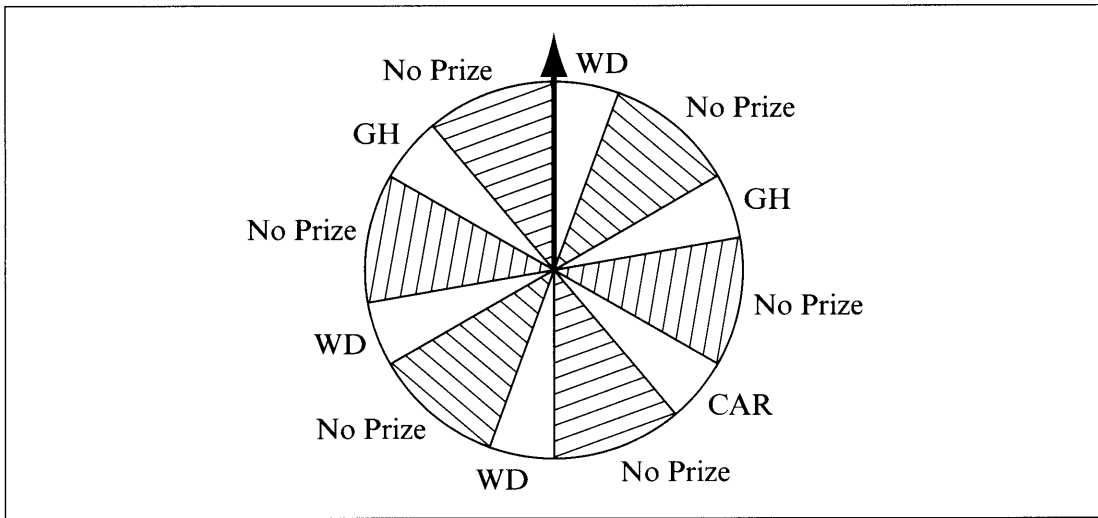


Working:

Answer:

(a) _____

10. On a certain game show, contestants spin a wheel to win a prize, as shown in the diagram. The larger angles are 40° (the shaded sectors), and the smaller angles are 20° .



Find the probability that a contestant

- (a) will **not** win a prize ;
- (b) will win a holiday in Greece (GH) ;
- (c) will win a washer/dryer (WD) , given that he knows that he has won a prize ;
- (d) will win a holiday in Greece **or** a washer/dryer.

Working:

Answers:

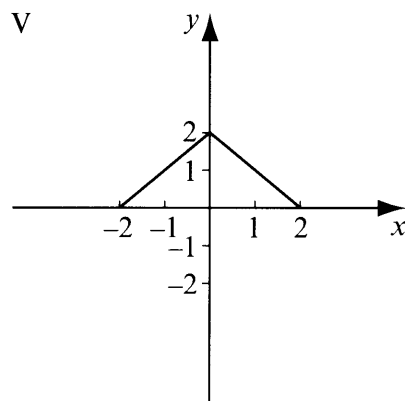
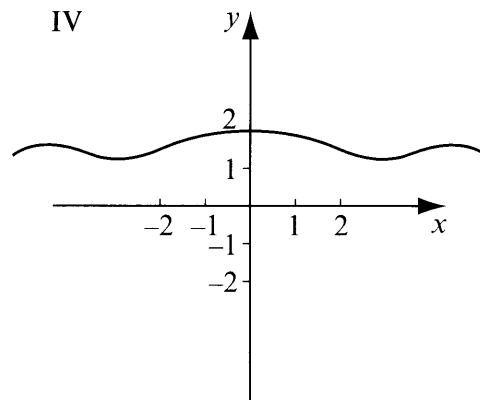
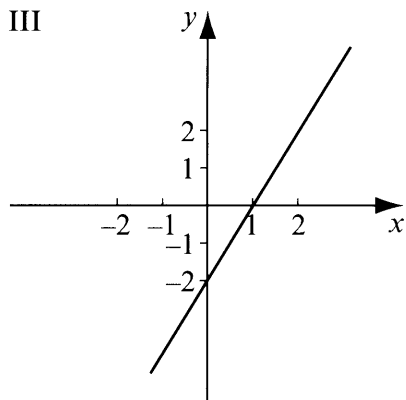
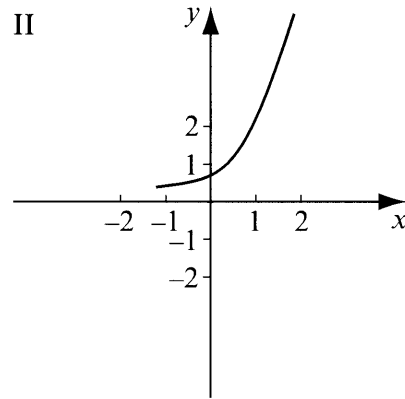
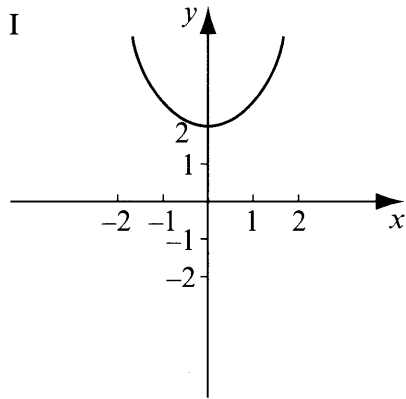
(a) _____

(b) _____

(c) _____

(d) _____

11. The following diagrams show the graphs of five functions.



(This question continues on the following page)

(Question 11 continued)

Each of the following sets represents the range of one of the functions of the graphs on the previous page.

- (a) $\{y \mid y \in \mathbb{R}\}$
- (b) $\{y \mid y \geq 2\}$
- (c) $\{y \mid y > 0\}$
- (d) $\{y \mid 1 \leq y \leq 2\}$

Write down which diagram is linked to each set.

Working:

Answers:

- (a) _____
- (b) _____
- (c) _____
- (d) _____

12. Hassan invested 10 000 CHF at the end of 1971. The interest rate was 5% per annum. How much interest **in total** would Hassan have earned at the end of the year 1999 if
- (a) he had removed the interest from his account at the end of each year ;
 - (b) he had **not** removed the interest from his account at the end of each year.

Working:

Answers:

(a) _____

(b) _____

13. Of a group of five students, two will be selected to visit the United Nations. The five students are John, Maria, Raul, Henri and Susan.
- (a) With the aid of a tree diagram or a table of outcomes, find the number of **different** possible combinations of students that could go to the United Nations.
 - (b) Find the probability that both Maria and Susan will go on the trip.

Working:

Answers:

(a) _____

(b) _____

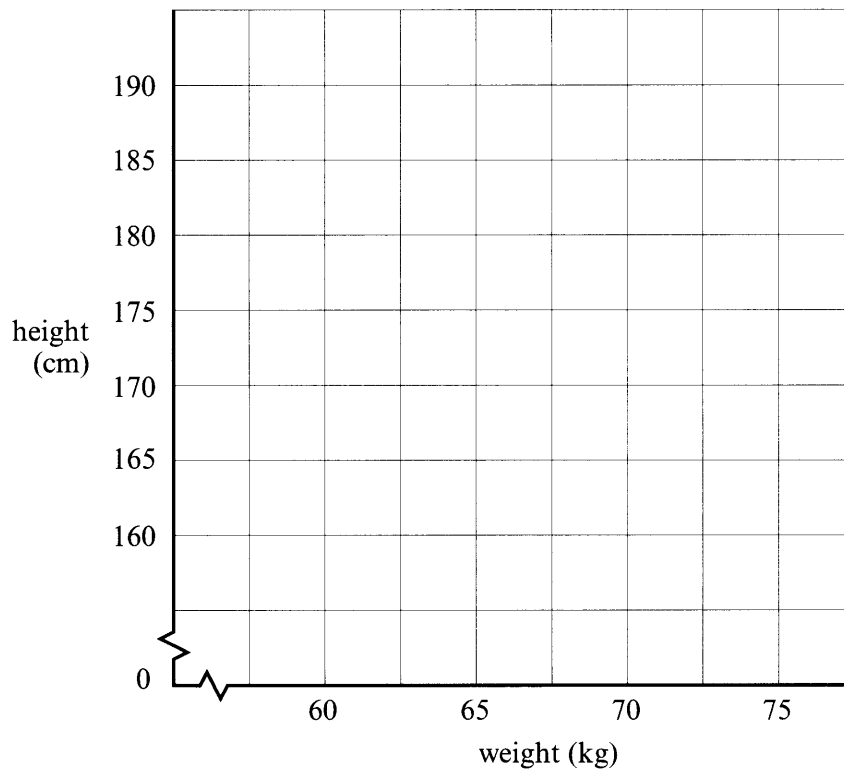
14. The following table gives the heights and weights of five sixteen-year-old boys.

Name	Height	Weight
Blake	182 cm	73 kg
Jorge	173 cm	68 kg
Chin	162 cm	60 kg
Ravi	178 cm	66 kg
Derek	190 cm	75 kg

(a) Find

- (i) the mean height ;
- (ii) the mean weight.

(b) Plot the above data on the grid below and draw the line of best fit.



Working:

Answers:

(a) (i) _____

(ii) _____

15. (a) For $y = 0.5 \cos 0.5 x$, find

(i) the amplitude ;

(ii) the period .

(b) Let $y = -3 \sin x + 2$, where $90^\circ \leq x \leq 270^\circ$.

By drawing the graph of y or otherwise, complete the table below for the given values of y .

x	y
	-1
	2

Working:

Answers:

(a) (i) _____

(ii) _____