IBO IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

MATHEMATICAL METHODS
STANDARD LEVEL
PAPER 1

Candidate number

Monday 5 May 2003 (afternoon)

1 hour

INSTRUCTIONS TO CANDIDATES

- Write your candidate number in the box 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.
- Write the make and model of your calculator in the appropriate box on your cover sheet *e.g.* Casio *fx-9750G*, Sharp EL-9600, Texas Instruments TI-85.

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

1. Gwendolyn added the multiples of 3, from 3 to 3750 and found that

$$3 + 6 + 9 + \ldots + 3750 = s.$$

Calculate s.

Working:

Answer:

2.   Find the term containing x^{10} in the expansion of $(5+2x^2)^7$.

Working:

Answer:

3. The number of hours of sleep of 21 students are shown in the frequency table below

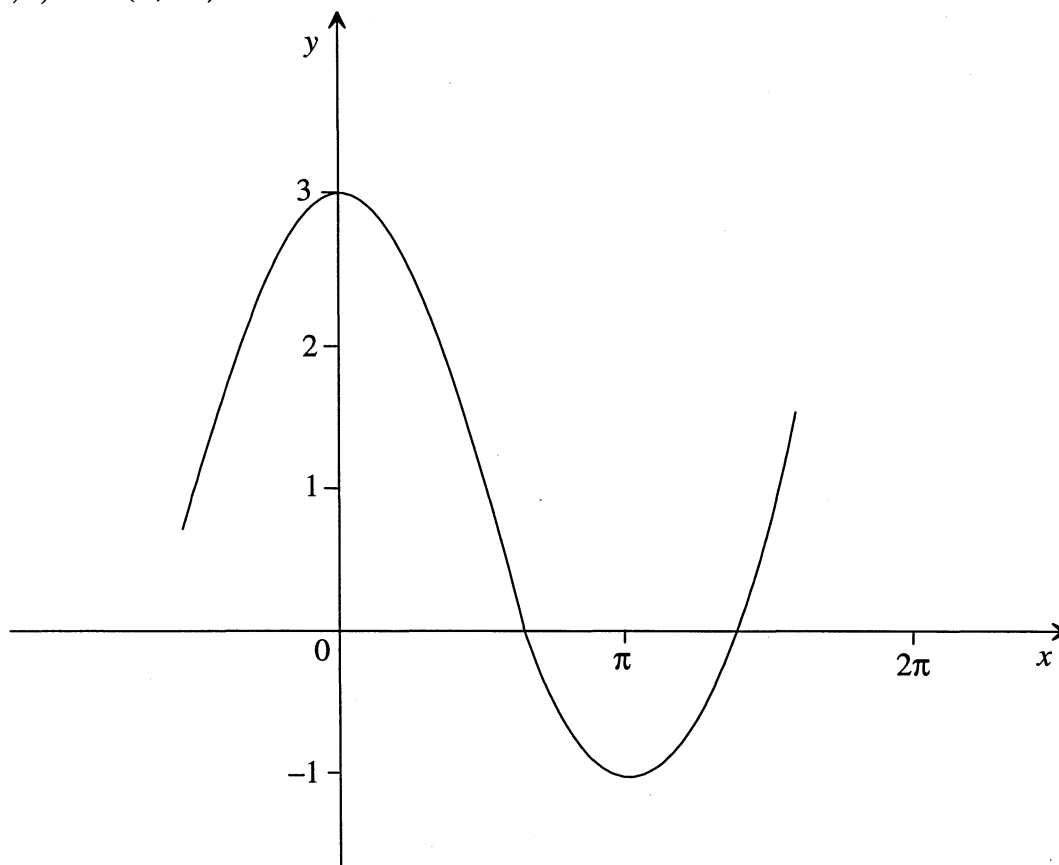| Hours of sleep	Number of students
4	2
5	5
6	4
7	3
8	4
10	2
12	1

Find

(a) the median;

(b) the lower quartile;

(c) the interquartile range.

Working:

Answers:

(a) _____

(b) _____

(c) _____

0414

4. Part of the graph of $y = p + q \cos x$ is shown below. The graph passes through the points $(0, 3)$ and $(\pi, -1)$.

Find the value of

(a) p ;

(b) q .

Working:

Answers:

(a) _____

(b) _____

5. Let $f(x) = e^{\frac{x}{3}} + 5\cos^2 x$. Find $f'(x)$.

Working:

Answer:

6. Find all solutions of the equation $\cos 3x = \cos(0.5x)$, for $0 \le x \le \pi$.

Working:

Answer:

7. The vector equations of two lines are given below.

$$r_1 = \begin{pmatrix} 5 \\ 1 \end{pmatrix} + \lambda \begin{pmatrix} 3 \\ -2 \end{pmatrix}, \quad r_2 = \begin{pmatrix} -2 \\ 2 \end{pmatrix} + t \begin{pmatrix} 4 \\ 1 \end{pmatrix}.$$

The lines intersect at the point P. Find the position vector of P.

Working:

Answer:

8. Consider events A, B such that $P(A) \neq 0, P(A) \neq 1, P(B) \neq 0$, and $P(B) \neq 1$.

In each of the situations (a), (b), (c) below state whether A and B are

mutually exclusive (M);
independent (I);
neither (N).

(a) $P(A|B) = P(A)$

(b) $P(A \cap B) = 0$

(c) $P(A \cap B) = P(A)$

Working:

Answers:

(a) _____

(b) _____

(c) _____

0814

9. Given that $\int_1^3 g(x)\,dx = 10$, deduce the value of

(a) $\int_1^3 \dfrac{1}{2} g(x)\,dx$;

(b) $\int_1^3 \left(g(x) + 4 \right)\,dx$.

Working:

Answers:

(a) _____

(b) _____

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10. Given that $\log_5 x = y$, express each of the following in terms of y.

(a) $\log_5 x^2$

(b) $\log_5 \left(\dfrac{1}{x} \right)$

(c) $\log_{25} x$

Working:

Answers:

(a) _____

(b) _____

(c) _____

1014

11. Let $f(x) = e^{-x}$, and $g(x) = \dfrac{x}{1+x}$, $x \neq -1$. Find

    (a) $f^{-1}(x)$;

    (b) $(g \circ f)(x)$.

Working:

Answers:

(a) _____

(b) _____

12. Consider the vectors $c = 3i + 4j$ and $d = 5i - 12j$.

    (a)   Calculate the scalar product $c \cdot d$.

    (b)   Calculate the scalar projection of the vector c in the direction of the vector d.

Working:

Answers:

(a) _____

(b) _____

1114

13. A family of functions is given by

$$f(x) = x^2 + 3x + k, \text{ where } k \in \{1, 2, 3, 4, 5, 6, 7\}.$$

One of these functions is chosen at random. Calculate the probability that the curve of this function crosses the x-axis.
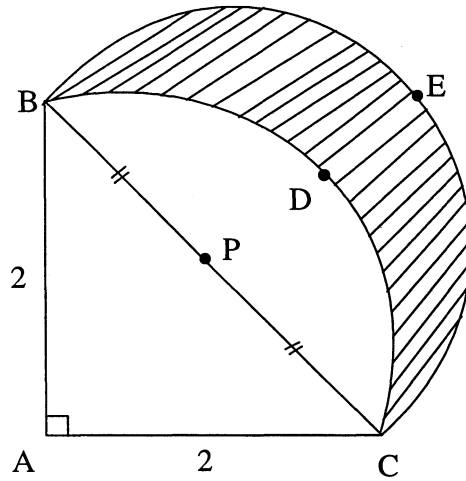
Working:

Answer:

14. The diagram below shows a triangle and two arcs of circles.

The triangle ABC is a right-angled isosceles triangle, with AB = AC = 2. The point P is the midpoint of [BC].

The arc BDC is part of a circle with centre A.

The arc BEC is part of a circle with centre P.

(a) Calculate the area of the segment BDCP.

(b) Calculate the area of the shaded region BECD.

Working:
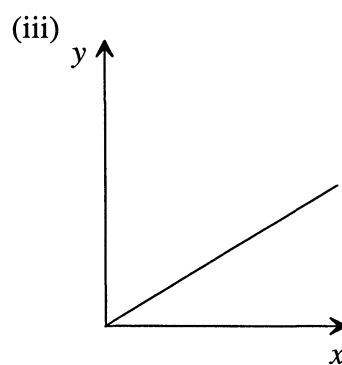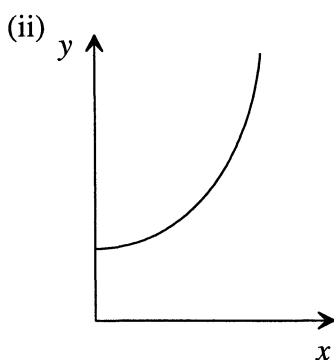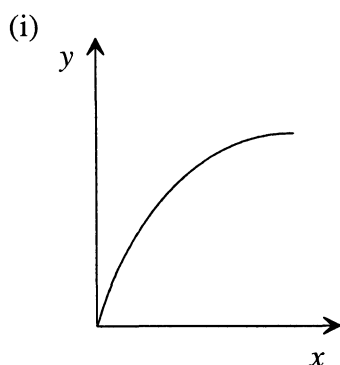
Answers:

(a) _____

(b) _____

1314

15. Consider the following relations between two variables x and y.

A. $y = \sin x$

B. y is directly proportional to x

C. $y = 1 + \tan x$

D. speed y as a function of time x, constant acceleration

E. $y = 2^x$

F. distance y as a function of time x, velocity decreasing

Each sketch below could represent **exactly** two of the above relations on a certain interval.

(i)

(ii)

(iii)

Complete the table below, by writing the letter for the **two** relations that each sketch could represent.

sketch	relation letters	
(i)		
(ii)		
(iii)		