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

M05/5/MATME/SP1/ENG/TZ0/XX

22057301

MATHEMATICAL METHODS
STANDARD LEVEL
PAPER 1

Tuesday 3 May 2005 (afternoon)

1 hour

Candidate session number

0	0							

INSTRUCTIONS TO CANDIDATES

- Write your session 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.

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. Let S_n be the sum of the first *n* terms of an arithmetic sequence, whose first three terms are u_1, u_2 and u_3. It is known that $S_1 = 7$, and $S_2 = 18$.

(a) Write down u_1.

(b) Calculate the common difference of the sequence.

(c) Calculate u_4.

Working:

Answers:

(a) _____

(b) _____

(c) _____

2. Consider the line L with equation $y + 2x = 3$. The line L_1 is parallel to L and passes through the point $(6, -4)$.

(a) Find the gradient of L_1.

(b) Find the equation of L_1 in the form $y = mx + b$.

(c) Find the x-coordinate of the point where line L_1 crosses the x-axis.

Working:

Answers:

(a) _____

(b) _____

(c) _____

3. Consider the expansion of $(x^2 - 2)^5$.

(a) Write down the number of terms in this expansion.

(b) The first four terms of the expansion in descending powers of x are

$$x^{10} - 10x^8 + 40x^6 + Ax^4 + ...$$

Find the value of A.

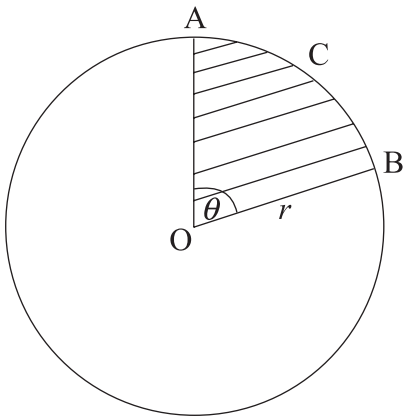
Working:

Answers:

(a) _____

(b) _____

4. The following diagram shows a circle of centre O, and radius *r*. The shaded sector OACB has an area of $27\ \text{cm}^2$. Angle $\text{AOB} = \theta = 1.5$ radians.



(a) Find the radius.

(b) Calculate the length of the minor arc ACB.

Working:

Answers:

(a) _____

(b) _____

5. Two unbiased 6-sided dice are rolled, a red one and a black one. Let E and F be the events

E : the same number appears on both dice;

F : the sum of the numbers is 10.

Find

(a) $\mathrm{P}(E)$;

(b) $\mathrm{P}(F)$;

(c) $\mathrm{P}(E \cup F)$.

Working:

Answers:

(a) _____

(b) _____

(c) _____

6. Let $f(x) = (3x+4)^5$. Find

(a) $f'(x)$;

(b) $\int f(x)\,\mathrm{d}x$.

Working:

Answers:

(a) _____

(b) _____

7. Find the **exact** solution of the equation $9^{2x} = 27^{(1-x)}$.

Working:

Answer:

_____

8. The curve $y = f(x)$ passes through the point (2, 6).

Given that $\frac{dy}{dx} = 3x^2 - 5$, find y in terms of x.

Working:

Answer:

9. (a) Given that $\log_3 x - \log_3(x-5) = \log_3 A$, express A in terms of x.

(b) Hence or otherwise, solve the equation $\log_3 x - \log_3(x-5) = 1$.

Working:

Answers:

(a)

(b)

10. Find the cosine of the angle between the two vectors $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$ and $\begin{pmatrix} -2 \\ 1 \end{pmatrix}$.

Working:

Answer:

11. The 45 students in a class each recorded the number of whole minutes, x, spent doing experiments on Monday. The results are $\sum x = 2\,230$.

(a) Find the mean number of minutes the students spent doing experiments on Monday.

Two new students joined the class and reported that they spent 37 minutes and 30 minutes respectively.

(b) Calculate the new mean including these two students.

Working:

Answers:

(a) _____

(b) _____

12. The function f is given by $f(x) = e^{(x-11)} - 8$.

(a) Find $f^{-1}(x)$.

(b) Write down the domain of $f^{-1}(x)$.

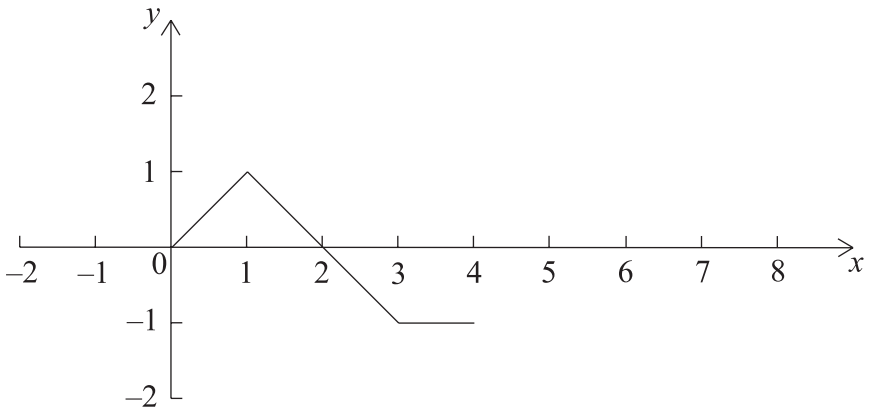
Working:

Answers:

(a) _____

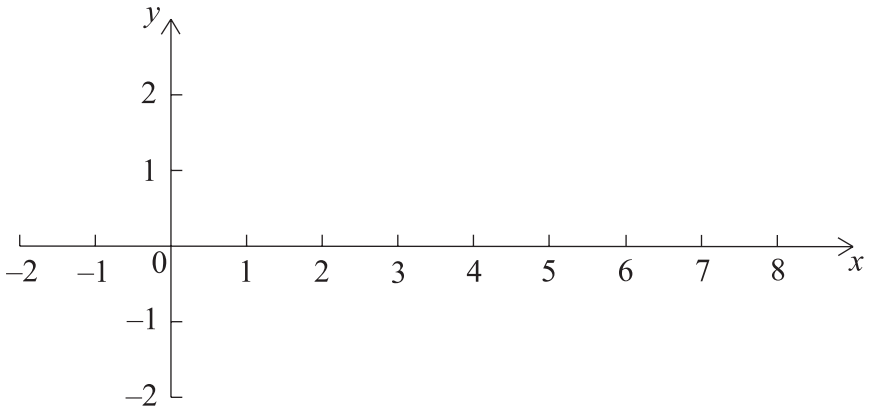
(b) _____

13. The graph of $y = f(x)$ is shown in the diagram.

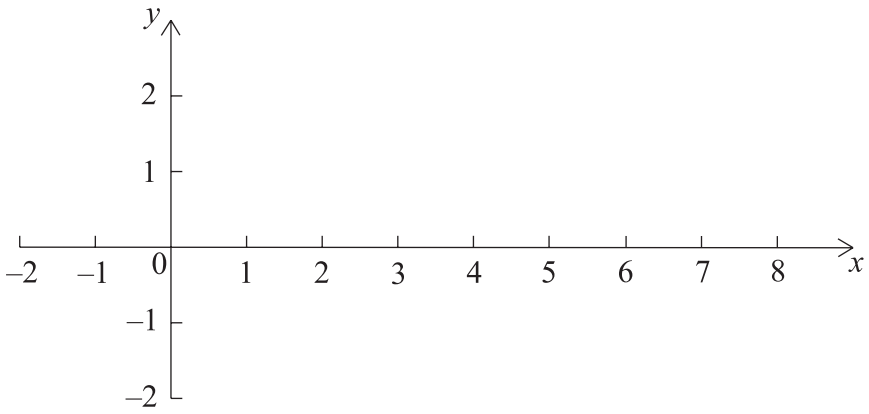


(a) On each of the following diagrams draw the required graph.

(i) $y = 2f(x)$;



(ii) $y = f(x-3)$.



(This question continues on the following page)

(Question 13 continued)

(b) The point $\mathrm{A}(3, -1)$ is on the graph of f. The point A' is the corresponding point on the graph of $y = -f(x) + 1$. Find the coordinates of A'.

Working:

Answer:

(b) _____

14. Consider $y = \sin\left(x + \frac{\pi}{9}\right)$.

(a) The graph of y intersects the x-axis at point A. Find the x-coordinate of A, where $0 \le x \le \pi$.

(b) Solve the equation $\sin\left(x + \frac{\pi}{9}\right) = -\frac{1}{2}$, for $0 \le x \le 2\pi$.

Working:

Answers:

(a) _____

(b) _____

15. The table below shows some values of two functions, f and g, and of their derivatives f' and g'.

x	1	2	3	4
$f(x)$	5	4	–1	3
$g(x)$	1	–2	2	–5
$f'(x)$	5	6	0	7
$g'(x)$	–6	–4	–3	4

Calculate the following.

(a) $\frac{\mathrm{d}}{\mathrm{d}x}\big(f(x)+g(x)\big)$, when $x=4$;

(b) $\int_1^3 \big(g'(x)+6\big)\mathrm{d}x$.

Working:

Answers:

(a) _____

(b) _____