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

MATHEMATICAL METHODS
STANDARD LEVEL
PAPER 1

Tuesday 7 May 2002 (afternoon)

1 hour

Name

Number

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.
- Write the make and model of your calculator in the box below *e.g.* Casio *fx-9750G*, Sharp EL-9600, Texas Instruments TI-85.

Calculator

Make	Model

EXAMINER	TEAM LEADER	IBCA
TOTAL /90	TOTAL /90	TOTAL /90

0116

*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. Solutions found from a graphic display calculator should be supported by suitable working. For example, if graphs are used to find a solution, you should sketch these as part of your answer. Incorrect answers with no working will normally receive **no** marks.*

1. From January to September, the mean number of car accidents per month was 630. From October to December, the mean was 810 accidents per month.

What was the mean number of car accidents per month for the whole year?

Working:

Answer:

0216

2. In an arithmetic sequence, the first term is –2 , the fourth term is 16 , and the nth term is 11 998 .

(a) Find the common difference d .

(b) Find the value of n .

Working:

Answers:

(a) _____

(b) _____

3. Let $f(x) = 2^x$, and $g(x) = \dfrac{x}{x-2}$, $(x \neq 2)$.

Find

(a) $(g \circ f)(3)$;

(b) $g^{-1}(5)$.

Working:

Answers:

(a) _____

(b) _____

Turn over

0316

4. The following diagram shows a circle of centre O , and radius 15 cm. The arc ACB subtends an angle of 2 radians at the centre O .
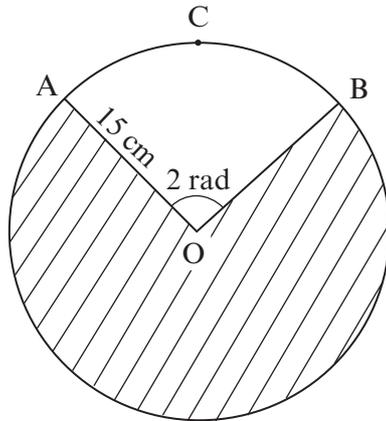

Diagram not to scale

AÔB = 2 radians.
OA = 15 cm.

Find

(a) the length of the arc ACB ;

(b) the area of the shaded region.

Working:

Answers:

(a) _____

(b) _____

0416

5. A vector equation of a line is $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \end{pmatrix} + t \begin{pmatrix} -2 \\ 3 \end{pmatrix}, t \in \mathbb{R}$.

Find the equation of this line in the form $ax + by = c$, where a, b, and $c \in \mathbb{Z}$.

Working:

Answer:

Turn over

0516

6. Two boats A and B start moving from the same point P . Boat A moves in a straight line at 20 km h^{-1} and boat B moves in a straight line at 32 km h^{-1} . The angle between their paths is 70°.

Find the distance between the boats after 2.5 hours.

Working:

Answer:

7. Consider the expansion of $\left(3x^2 - \dfrac{1}{x} \right)^9$.

(a) How many terms are there in this expansion?

(b) Find the constant term in this expansion.

Working:

Answers:

(a) _____

(b) _____

8. Let $f(x) = \sin 2x$ and $g(x) = \sin(0.5x)$.

    (a) Write down

        (i)   the minimum value of the function f ;

        (ii) the period of the function g .

    (b) Consider the equation $f(x) = g(x)$.

        Find the number of solutions to this equation, for $0 \leq x \leq \dfrac{3\pi}{2}$.

Working:

Answers:

(a) (i) _____

    (ii) _____

(b) _____

Turn over

9. Solve the equation $\log_{27} x = 1 - \log_{27} (x - 0.4)$.

Working:

Answer:

10. The derivative of the function f is given by $f'(x) = \dfrac{1}{x+1} - 0.5\sin x$, for $x \neq -1$.

The graph of f passes through the point $(0, 2)$. Find an expression for $f(x)$.

Working:

Answer:

11. A box contains 22 red apples and 3 green apples. Three apples are selected at random, one after the other, without replacement.

(a) The first two apples are green. What is the probability that the third apple is red?

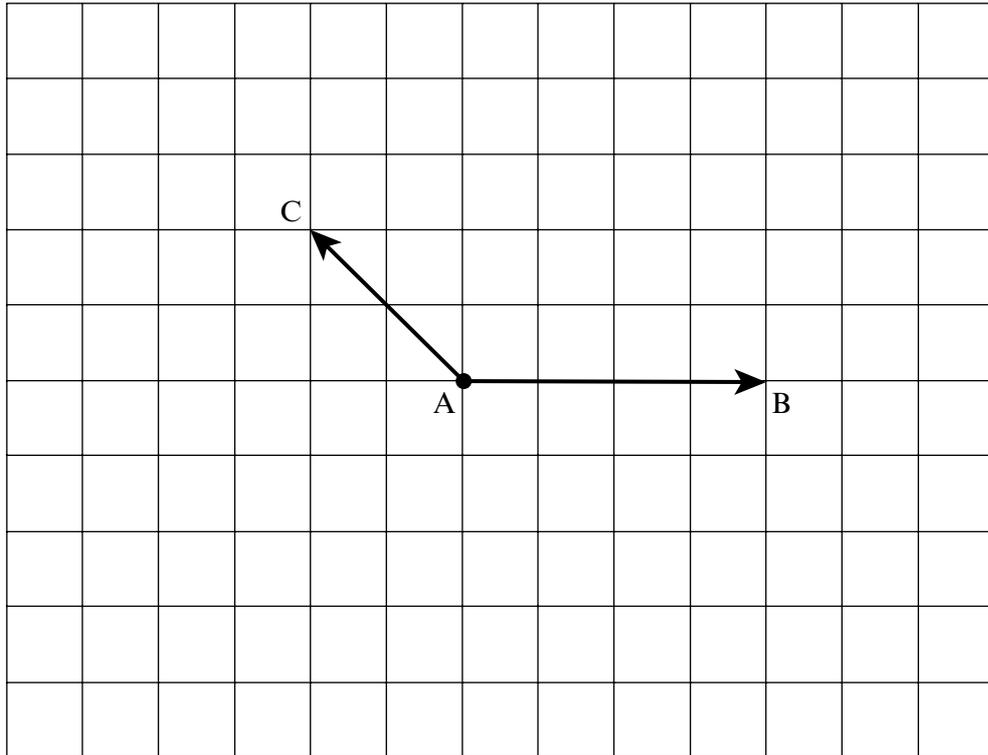(b) What is the probability that exactly two of the three apples are red?

Working:

Answers:

(a) _____

(b) _____

Turn over

0916

12. The diagram below shows the vectors $\vec{AB}$ and $\vec{AC}$.
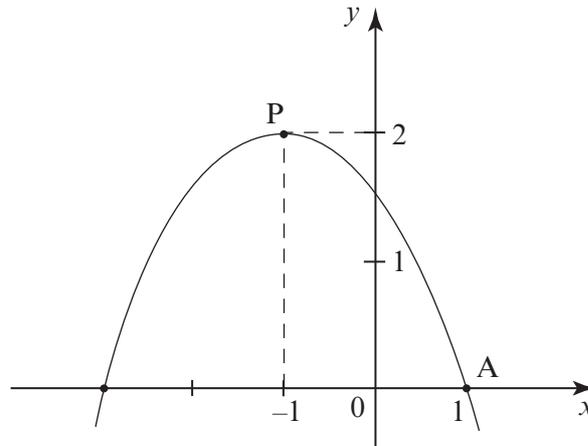

On the diagram, mark the following points

(a) the point D such that $\vec{AD} = 2\vec{AC}$;

(b) the point P such that $\vec{AP} = \vec{AB} - \vec{AC}$;

(c) the point Q such that $\vec{AQ}$ is the projection of the vector $\vec{AC}$ in the direction of $\vec{AB}$.

Working:

13. The diagram shows part of the graph of $y = a(x - h)^2 + k$. The graph has its vertex at P , and passes through the point A with coordinates $(1, 0)$.

(a) Write down the value of

  (i) h ;

  (ii) k .

(b) Calculate the value of a .

Working:

Answers:

(a) (i) _____

   (ii) _____

(b) _____

1116

14.   **Figure 1** shows the graphs of the functions f_1, f_2, f_3, f_4.

Figure 2 includes the graphs of the derivatives of the functions shown in **Figure 1**, *e.g.* the derivative of f_1 is shown in diagram (d).
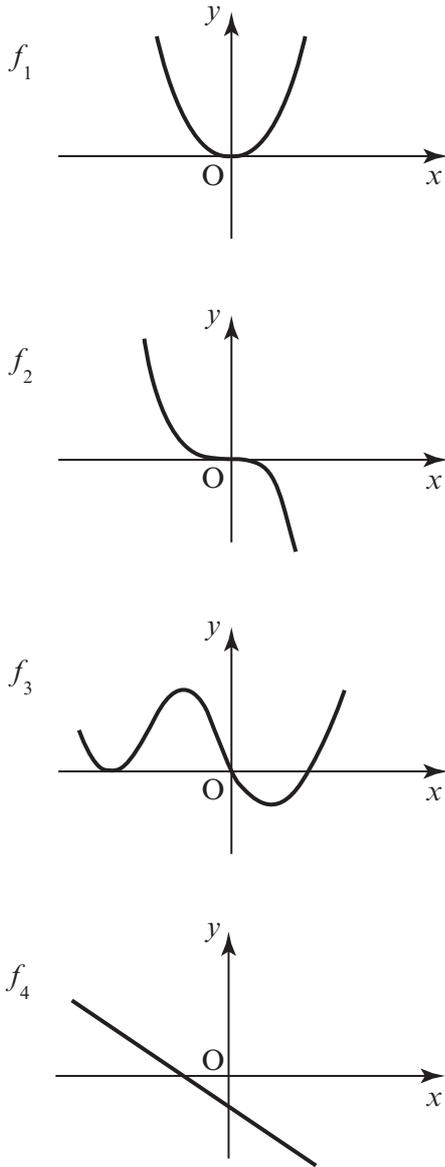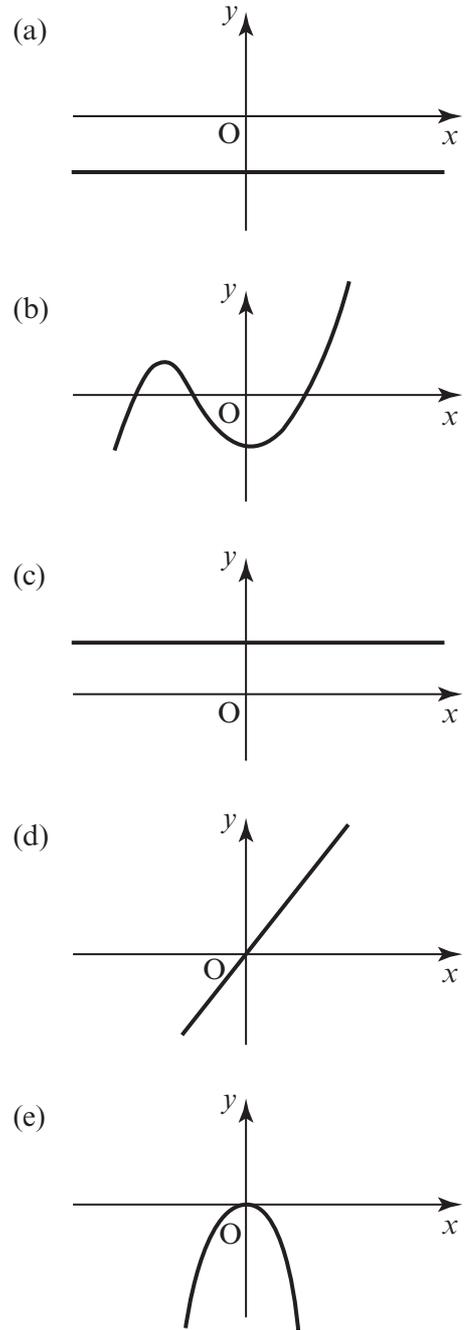
Figure 1

f_1

f_2

f_3

f_4

Figure 2

(a)

(b)

(c)

(d)

(e)

(This question continues on the following page)

222–242

1216

(Question 14 continued)

Complete the table below by matching each function with its derivative.

Function	Derivative diagram
f_1	(d)
f_2	
f_3	
f_4	

Working:

Turn over

1316

15. Consider the following statements

A: $\log_{10}(10^x) > 0$.

B: $-0.5 \le \cos(0.5x) \le 0.5$.

C: $-\dfrac{\pi}{2} \le \arctan x \le \dfrac{\pi}{2}$.

(a) Determine which statements are true for all real numbers x. Write your answers (yes or no) in the table below.

Statement	(a) Is the statement true for all real numbers x? (Yes/No)	(b) If not true, example
A		
B		
C		

(b) If a statement is not true for all x, complete the last column by giving an example of one value of x for which the statement is false.

Working: