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

N04/5/MATME/SP1/ENG/TZ0/XX

88047201

MATHEMATICAL METHODS
STANDARD LEVEL
PAPER 1

Wednesday 3 November 2004 (afternoon)

1 hour

School code

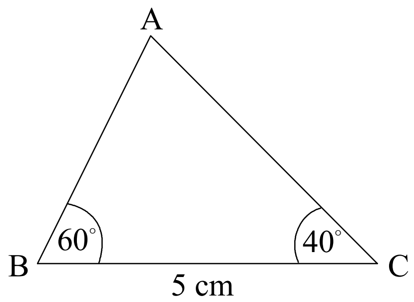
Candidate code

INSTRUCTIONS TO CANDIDATES

- Write your school code and candidate code 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.
- Indicate the make and model of your calculator in the appropriate box on your cover sheet.

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. The following diagram shows a triangle ABC, where $\text{BC} = 5\text{ cm}$, $\hat{\text{B}} = 60^\circ$, $\hat{\text{C}} = 40^\circ$.



(a) Calculate AB.

(b) Find the area of the triangle.

Working:

Answers:

(a) ______________________

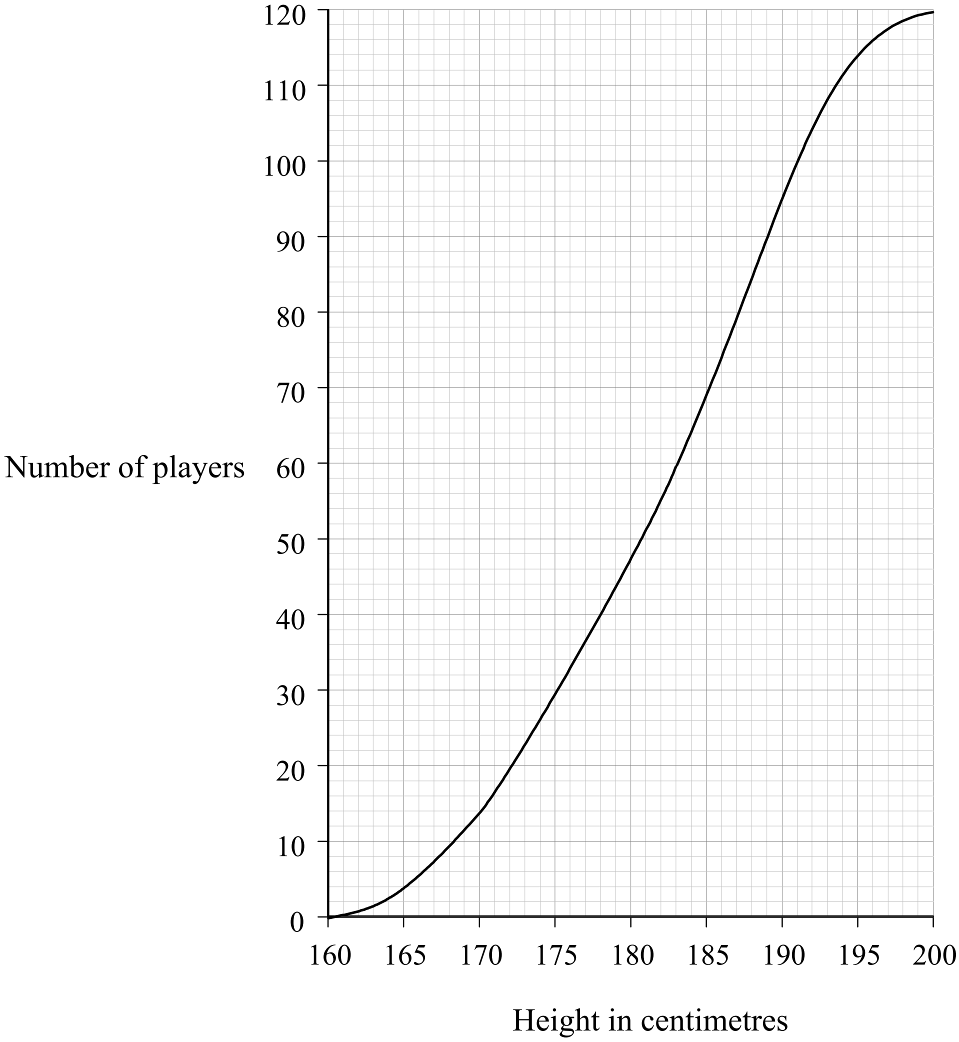
(b) ______________________

2. Let $f(x) = 6\sqrt[3]{x^2}$. Find $f'(x)$.

Working:

Answer:

3. The cumulative frequency curve below shows the heights of 120 basketball players in centimetres.



Use the curve to estimate

(a) the median height;

(b) the interquartile range.

Working:

Answers:

(a) ______________________

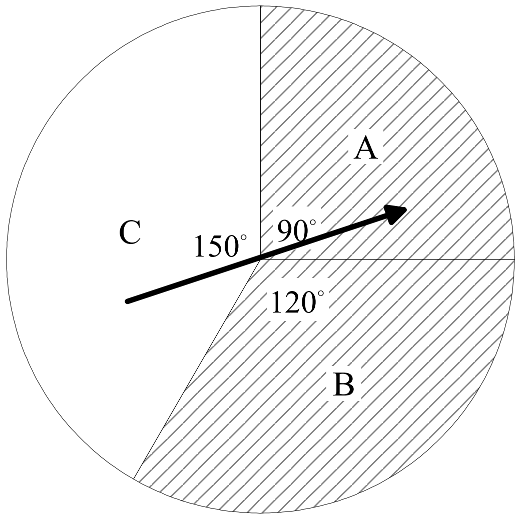
(b) ______________________

4. Find the term containing x^3 in the expansion of $(2-3x)^8$.

Working:

Answer:

5. The following diagram shows a circle divided into three sectors A, B and C. The angles at the centre of the circle are $90^\circ, 120^\circ$ and 150°. Sectors A and B are shaded as shown.



The arrow is spun. It cannot land on the lines between the sectors. Let *A, B, C* and *S* be the events defined by

A	:	Arrow lands in sector A
B	:	Arrow lands in sector B
C	:	Arrow lands in sector C
S	:	Arrow lands in a shaded region.

Find

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

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

(c) $\mathrm{P}(A|S)$.

Working:

Answers:

(a) ______________________________

(b) ______________________________

(c) ______________________________

6. Let $a = \log x$, $b = \log y$, and $c = \log z$.

Write $\log\left(\frac{x^2\sqrt{y}}{z^3}\right)$ in terms of a, b and c.

Working:

Answer:

....

7. Let a, b, c and d be integers such that $a < b$, $b < c$ and $c = d$.

The mode of these four numbers is 11.
The range of these four numbers is 8.
The mean of these four numbers is 8.

Calculate the value of each of the integers a, b, c, d.

Working:

Answers:

$a =$, $b =$

$c =$, $d =$

8. Let $f(x) = 2x + 1$ and $g(x) = 3x^2 - 4$.

Find

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

(b) $(g \circ f)(-2)$;

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

Working:

Answers:

(a) ______________________________

(b) ______________________________

(c) ______________________________

9. The displacement s metres of a car, t seconds after leaving a fixed point A, is given by

$$s = 10t - 0.5t^2 .$$

(a) Calculate the velocity when $t = 0$.

(b) Calculate the value of t when the velocity is zero.

(c) Calculate the displacement of the car from A when the velocity is zero.

Working:

Answers:

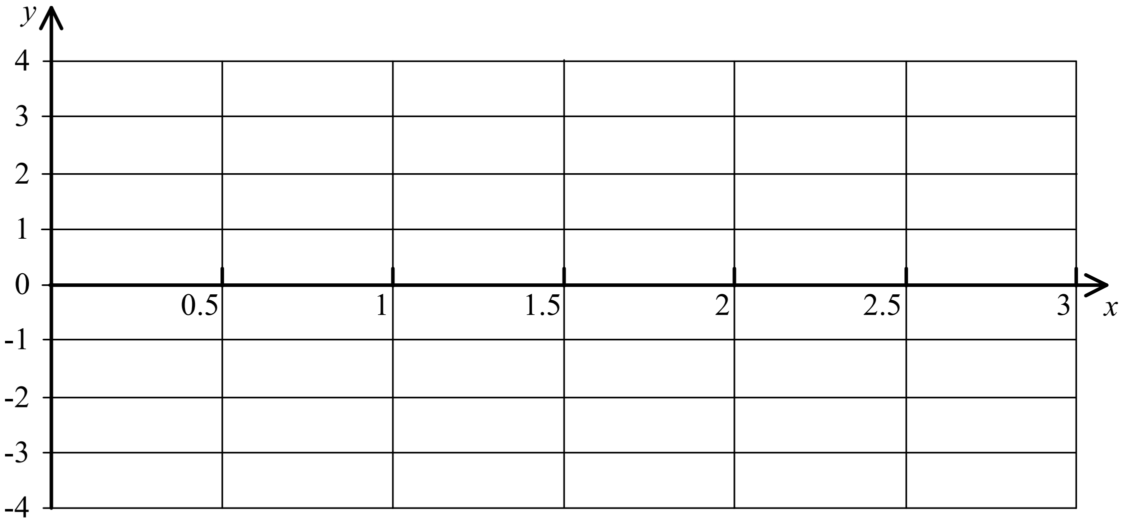
(a) ______________________________

(b) ______________________________

(c) ______________________________

10. Let $f(x) = 2 + \cos(2x) - 2\sin(0.5x)$ for $0 \le x \le 3$, where x is in radians.

(a) On the grid below, sketch the curve of $y = f(x)$, indicating clearly the point P on the curve where the derivative is zero.



(b) Write down the solutions of $f(x) = 0$.

Answer:

(b) ______________________________

11. The population p of bacteria at time t is given by $p = 100\mathrm{e}^{0.05t}$.

Calculate

(a) the value of p when $t = 0$;

(b) the rate of increase of the population when $t = 10$.

Working:

Answers:

(a) ______________________________

(b) ______________________________

12. The derivative of the function f is given by $f'(x) = e^{-2x} + \frac{1}{1-x}$, $x < 1$.

The graph of $y = f(x)$ passes through the point $(0, 4)$. Find an expression for $f(x)$.

Working:

Answer:

13. Let f be a function such that $\int_0^3 f(x)\,\mathrm{d}x = 8$.

(a) Deduce the value of

(i) $\int_0^3 2f(x)\,\mathrm{d}x$;

(ii) $\int_0^3 \left(f(x)+2\right)\mathrm{d}x$.

(b) If $\int_c^d f(x-2)\,\mathrm{d}x = 8$, write down the value of c and of d.

Working:

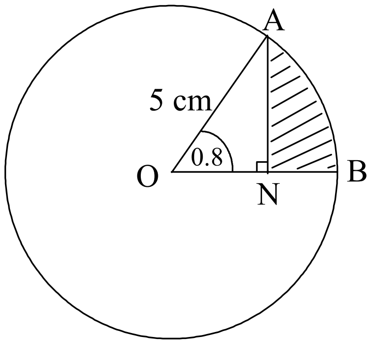
Answers:

(a) (i) ____________________

(ii) ____________________

(b) $c =$ __________ , $d =$ __________

14. The diagram below shows a circle of radius 5 cm with centre O. Points A and B are on the circle, and $A\hat{O}B$ is 0.8 radians. The point N is on [OB] such that [AN] is perpendicular to [OB].

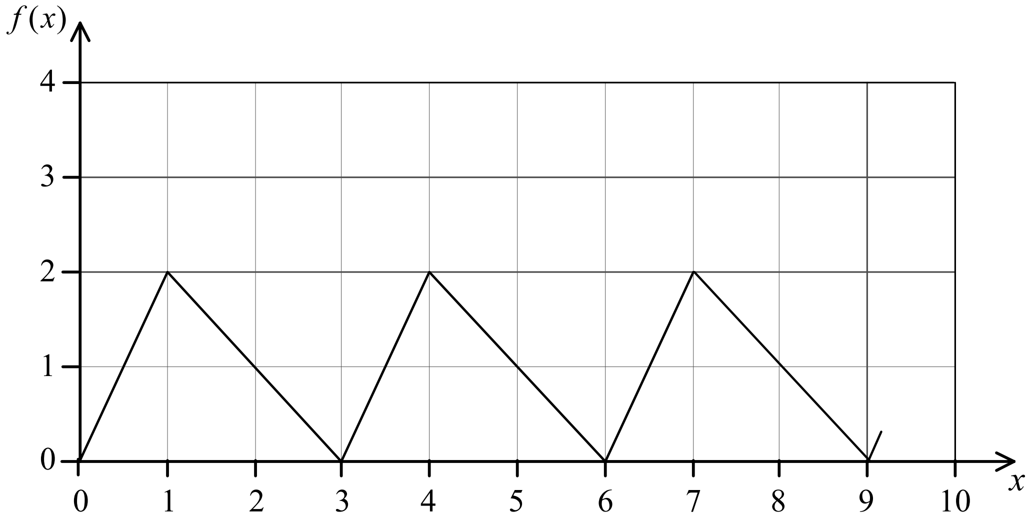


Find the area of the shaded region.

Working:

Answer:

15. Part of the graph of the periodic function f is shown below. The domain of f is $0 \le x \le 15$ and the period is 3.



(a) Find

(i) $f(2)$;

(ii) $f'(6.5)$;

(iii) $f'(14)$.

(b) How many solutions are there to the equation $f(x) = 1$ over the given domain?

Working:

Answers:

(a) (i) ____________________

(ii) ____________________

(iii) ____________________

(b) ____________________