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International Baccalaureate®
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MATHEMATICAL STUDIES
STANDARD LEVEL
PAPER 1

Candidate session number

0	0							

Thursday 3 May 2012 (afternoon)

1 hour 30 minutes

Examination code

2	2	1	2	–	7	4	0	3

INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- A graphic display calculator is required for this paper.
- A clean copy of the ***Mathematical Studies SL*** *information booklet* is required for this paper.
- Answer all questions
- Write your answers in the boxes provided.
- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
- The maximum mark for this examination paper is *[90 marks]*.

0120

Please **do not** write on this page.

Answers written on this page
will not be marked.

Maximum marks will be given for correct answers. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. Write your answers in the answer boxes provided. 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 **six** integers are arranged from smallest to largest

$$1, x, 3, y, 14, z$$

The mode is 1, the median is 5 and the mean is 7.

Find

(a) x; *[1 mark]*

(b) y; *[2 marks]*

(c) z. *[3 marks]*

Working:

Answers:

(a) . . . . . .

(b) . . . . . .

(c) . . . . . .

2. The coordinates of point A are $(-4, p)$ and the coordinates of point B are $(2, -3)$.

The mid-point of the line segment AB, has coordinates $(q, 1)$.

(a) Find the value of

(i) q;

(ii) p. *[4 marks]*

(b) Calculate the distance AB. *[2 marks]*

Working:

Answers:

(a) (i) . . . . . .

(ii) . . . . . .

(b) . . . . . .

3. Ross is a star that is 82 414 080 000 000 km away from Earth. A spacecraft, launched from Earth, travels at 48 000 kmh^{-1} towards Ross.

(a) Calculate the **exact** time, in hours, for the spacecraft to reach the star Ross. *[2 marks]*

(b) Give your answer to part (a) in years. (Assume 1 year = 365 days) *[2 marks]*

(c) Give your answer to part (b) in the form $a \times 10^k$, where $1 \leq a < 10$ and $k \in \mathbb{Z}$. *[2 marks]*

Working:

Answers:

(a) . . . . . .

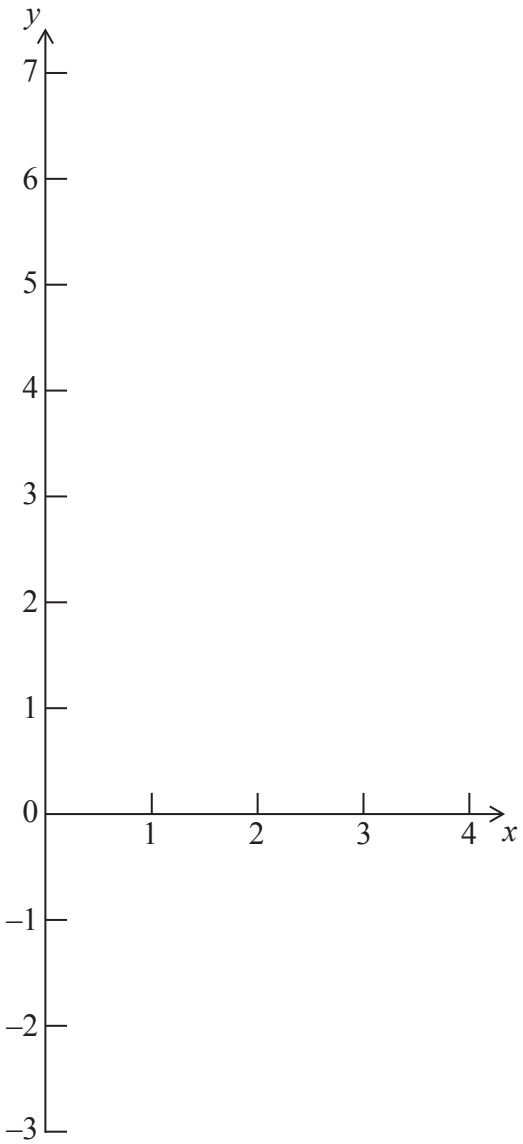
(b) . . . . . .

(c) . . . . . .

4. $y = f(x)$ is a quadratic function. The graph of $f(x)$ intersects the y-axis at the point A$(0, 6)$ and the x-axis at the point B$(1, 0)$. The vertex of the graph is at the point C$(2, -2)$.

(a) Write down the equation of the axis of symmetry. *[2 marks]*

(b) Sketch the graph of $y = f(x)$ on the axes below for $0 \leq x \leq 4$. Mark clearly on the sketch the points A, B, and C. *[3 marks]*



The graph of $y = f(x)$ intersects the x-axis for a second time at point D.

(c) Write down the x-coordinate of point D. *[1 mark]*

(This question continues on the following page)

(Question 4 continued)

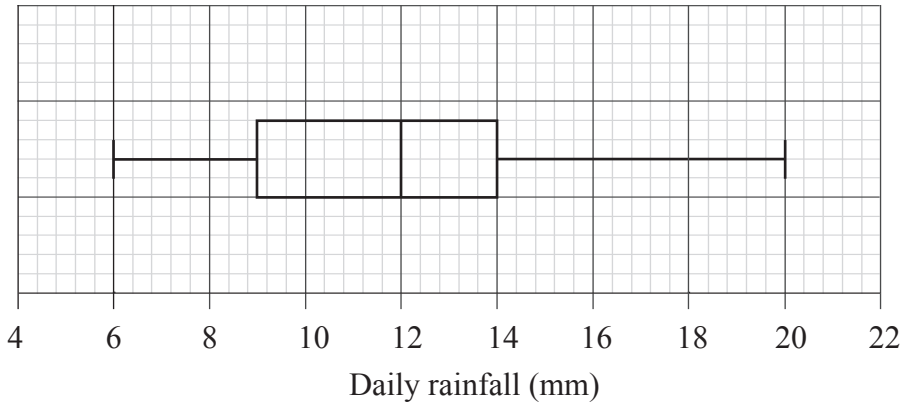
Working:

Answers:

(a) . . . . . .

(c) . . . . . .

5. The daily rainfall for the town of St. Anna is collected over a 20-day period of time. The collected data are represented in the box and whisker plot below.



(a) Write down

(i) the lowest daily rainfall;

(ii) the highest daily rainfall. *[2 marks]*

(b) State what the value of 12 mm represents on the given diagram. *[1 mark]*

(c) Find the interquartile range. *[2 marks]*

(d) Write down the percentage of the data which is less than the upper quartile. *[1 mark]*

Working:

Answers:

(a) (i) . . . . . .

(ii) . . . . . .

(b) . . . . . .

(c) . . . . . .

(d) . . . . . .

6. Consider the statements

p: The numbers x and y are both even.
q: The sum of x and y is an even number.

(a) Write down, in words, the statement $p \Rightarrow q$. *[2 marks]*

(b) Write down, in words, the inverse of the statement $p \Rightarrow q$. *[2 marks]*

(c) State whether the inverse of the statement $p \Rightarrow q$ is always true. Justify your answer. *[2 marks]*

Working:

Answers:

(a) . . . . . .

. . . . . .

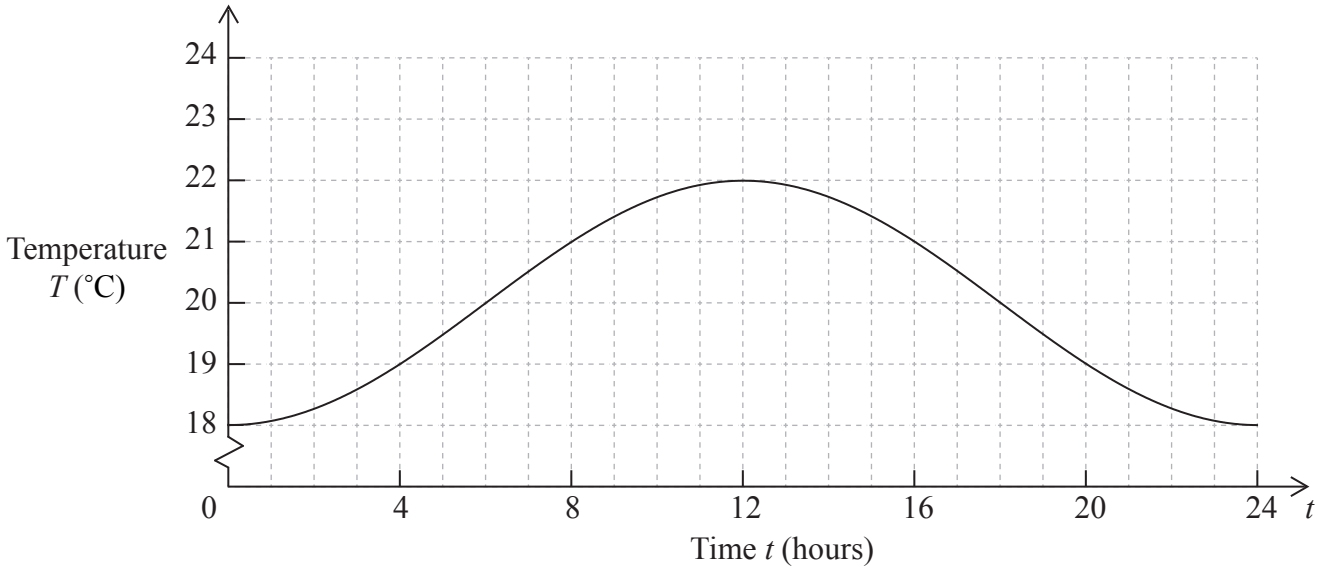
(b) . . . . . .

. . . . . .

(c) . . . . . .

. . . . . .

7. The temperature T of water in a lake, in °C, in a 24 hour period is given by the trigonometric function $T(t) = -2\cos(bt) + 20$, where b is a constant, and t is the time in hours from midnight. The graph of the function is given below.



(a) Write down the time at which the water reaches its maximum temperature. *[1 mark]*

(b) Write down the temperature at 06:00. *[1 mark]*

(c) Write down the time interval during which the temperature is higher than 20 °C. *[2 marks]*

(d) Calculate the value of b. *[2 marks]*

Working:

Answers:

(a) . . . . . .

(b) . . . . . .

(c) . . . . . .

(d) . . . . . .

8. Sasha travelled from the USA to Mexico and converted 650 US dollars (USD) to Mexican pesos (MXN). Her bank offered an exchange rate of 1 USD = 12.50 MXN.

(a) Find the number of MXN that Sasha received. *[2 marks]*

Before her return to the USA, Sasha exchanged 2300 MXN back into USD. The bank charged a commission of 1 %. The exchange rate was still 1 USD = 12.50 MXN.

(b) Write down the commission charged by the bank in MXN. *[1 mark]*

(c) Calculate the amount of USD that Sasha received after commission. Give your answer correct to the nearest USD. *[3 marks]*

Working:

Answers:

(a) . . . . . .

(b) . . . . . .

(c) . . . . . .

9. Line L is given by the equation $3y + 2x = 9$ and point P has coordinates $(6, -5)$.

(a) Explain why point P is not on the line L. *[1 mark]*

(b) Find the gradient of line L. *[2 marks]*

(c) (i) Write down the gradient of a line perpendicular to line L.

(ii) Find the equation of the line perpendicular to L and passing through point P. *[3 marks]*

Working:

Answers:

(a) . . . . . .

. . . . . .

(b) . . . . . .

(c) (i) . . . . . .

(ii) . . . . . .

10. The diagram shows quadrilateral ABCD in which AB = 13 m, AD = 6 m and DC = 10 m. Angle $\text{ADC} = 120^\circ$ and angle $\text{ABC} = 40^\circ$.

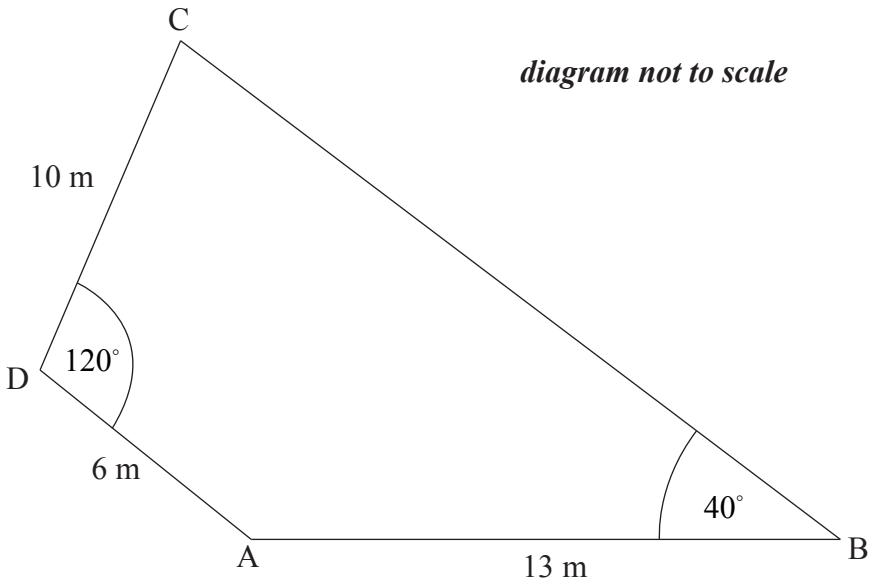


diagram not to scale

(a) Calculate the length of AC. *[3 marks]*

(b) Calculate the size of angle ACB. *[3 marks]*

Working:

Answers:

(a) . . . . . .

(b) . . . . . .

11. The number of calories a person burns during a walk depends on the time they spend walking. The table below shows the number of calories, y, burned by a person in relation to the time they spend walking, x, in minutes.

Time spent walking (x) (minutes)	10	15	20	25	30
Calories (y)	90	125	200	300	375

(a) Use your graphic display calculator to write down the equation of the regression line for y on x in the form $y = ax + b$. *[2 marks]*

(b) Use your equation to estimate the number of calories that a person will burn during a 17 minute walk. *[2 marks]*

(c) State whether your answer to part (b) is reliable. Give a reason for your answer. *[2 marks]*

Working:

Answers:

(a) . . . . . .

(b) . . . . . .

(c) . . . . . .

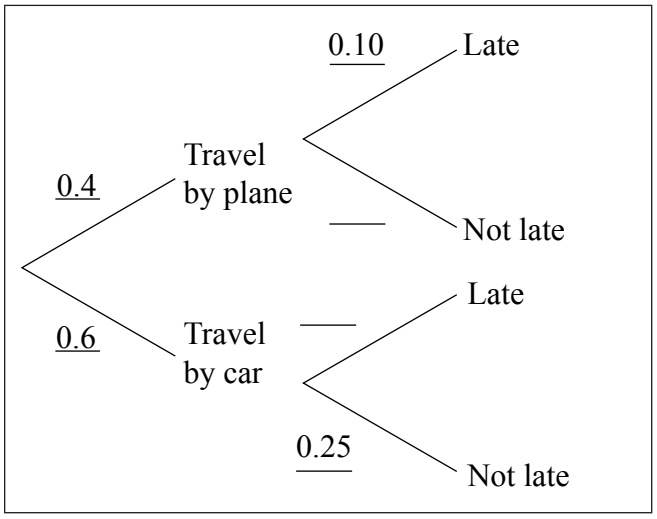
. . . . . .

12. Merryn plans to travel to a concert tomorrow. Due to bad weather, there is a 60 % chance that all flights will be cancelled tomorrow. If the flights are cancelled Merryn will travel by car.

If she travels by plane the probability that she **will be late** for the concert is 10 %.

If she travels by car, the probability that she **will not be late** for the concert is 25 %.

(a) Complete the tree diagram below. *[1 mark]*



(b) Find the probability that Merryn will not be late for the concert. *[3 marks]*

Merryn was not late for the concert the next day.

(c) Given that, find the probability that she travelled to the concert by car. *[2 marks]*

Working:

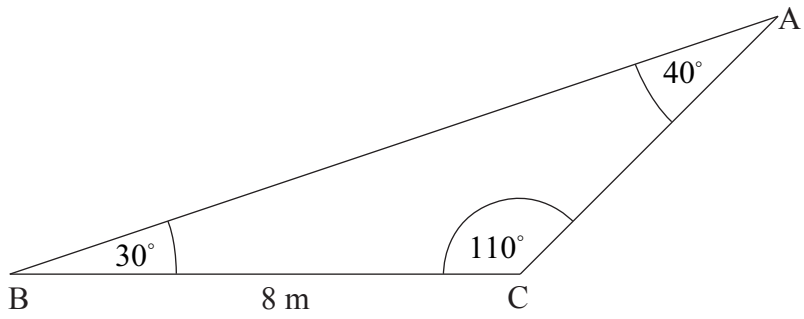
Answers:

(b) . . . . . .

(c) . . . . . .

13. In triangle ABC, BC = 8 m, angle ACB = 110°, angle CAB = 40°, and angle ABC = 30°.

diagram not to scale



(a) Find the length of AC. *[3 marks]*

(b) Find the area of triangle ABC. *[3 marks]*

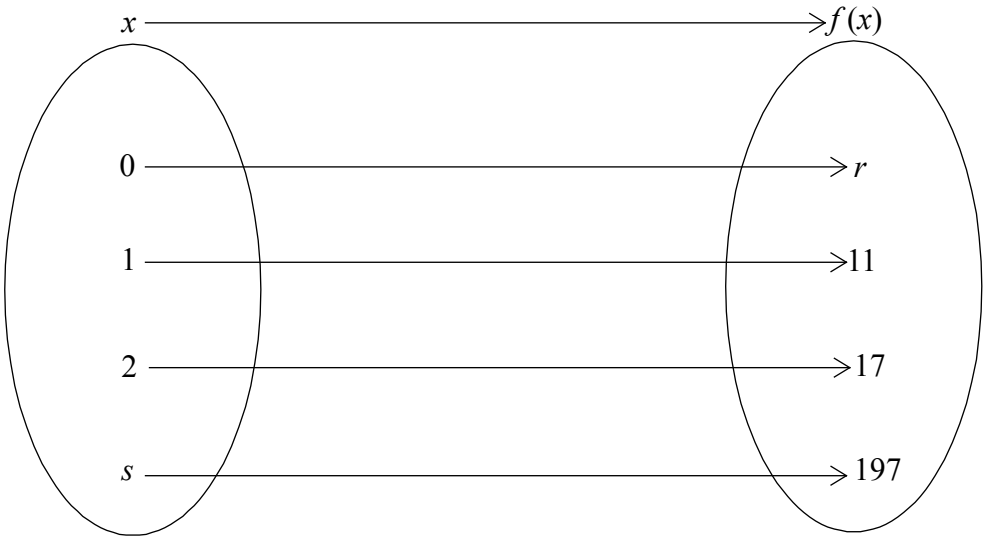
Working:

Answers:

(a) . . . . . .

(b) . . . . . .

14. A function $f(x) = p \quad 2^x + q$ is defined by the mapping diagram below.



(a) Find the value of

(i) p;

(ii) q. *[3 marks]*

(b) Write down the value of r. *[1 mark]*

(c) Find the value of s. *[2 marks]*

Working:

Answers:

(a) (i) . . . . . .

(ii) . . . . . .

(b) . . . . . .

(c) . . . . . .

15. Veronica wants to make an investment and accumulate 25 000 EUR over a period of 18 years. She finds two investment options.

Option 1 offers simple interest of 5 % per annum.

(a) Find out the **exact** amount she will have in her account after 18 years, if she invests 12 500 EUR with this option. *[3 marks]*

Option 2 offers a nominal annual interest rate of 4 %, **compounded monthly**.

(b) Find the amount that Veronica has to invest with option 2 to have 25 000 EUR in her account after 18 years. Give your answer correct to **two decimal places**. *[3 marks]*

Working:

Answers:

(a) . . . . . .

(b) . . . . . .

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