



22087404



International Baccalaureate®
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**MATHEMATICAL STUDIES
STANDARD LEVEL
PAPER 2**

Thursday 8 May 2008 (morning)

1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- Unless otherwise stated in the question, all numerical answers must be given exactly or correct to three significant figures.

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Please start each question on a new page. You are advised to show all working, where possible. Where an answer is wrong, some marks may be given for correct method, provided this is shown by written working. 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. [Maximum mark: 17]

- (a) Sketch the graph of the function $f(x) = \frac{2x+3}{x+4}$, for $-10 \leq x \leq 10$. Indicating clearly the axis intercepts and any asymptotes. [6 marks]
- (b) Write down the equation of the vertical asymptote. [2 marks]
- (c) On the same diagram sketch the graph of $g(x) = x + 0.5$. [2 marks]
- (d) Using your graphical display calculator write down the coordinates of **one** of the points of intersection on the graphs of f and g , **giving your answer correct to five decimal places**. [3 marks]
- (e) Write down the gradient of the line $g(x) = x + 0.5$. [1 mark]
- (f) The line L passes through the point with coordinates $(-2, -3)$ and is perpendicular to the line $g(x)$. Find the equation of L . [3 marks]

2. [Maximum mark: 20]

- (i) A group of 50 students completed a questionnaire for a Mathematical Studies project. The following data was collected.

18 students own a digital camera (D)
15 students own an ipod (I)
26 students own a cell phone (C)
1 student owns all three items
5 students own a digital camera and an ipod but not a cell phone
2 students own a cell phone and an ipod but not a digital camera
3 students own a cell phone and a digital camera but not an ipod

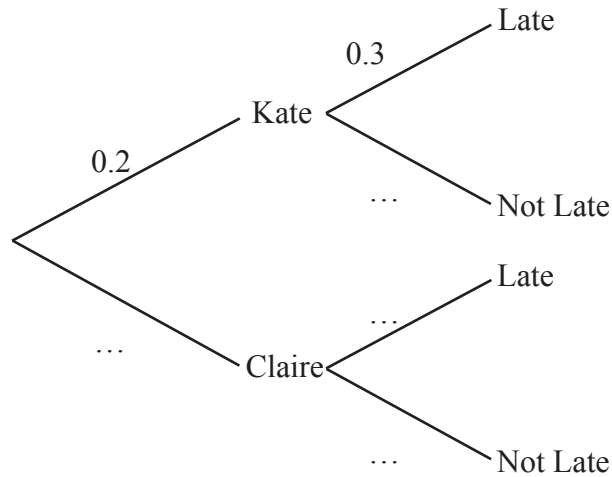
- (a) Represent this information on a Venn diagram. [4 marks]
- (b) Calculate the number of students who own none of the items mentioned above. [2 marks]
- (c) If a student is chosen at random, write down the probability that the student owns a digital camera **only**. [1 mark]
- (d) If two students are chosen at random, calculate the probability that they both own a cell phone **only**. [3 marks]
- (e) If a student owns an ipod, write down the probability that the student also owns a digital camera. [2 marks]

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(Question 2 continued)

- (ii) Claire and Kate both wish to go to the cinema but one of them has to stay at home to baby-sit.
The probability that Kate goes to the cinema is 0.2. If Kate does not go Claire goes.
If Kate goes to the cinema the probability that she is late home is 0.3.
If Claire goes to the cinema the probability that she is late home is 0.6.

- (a) Copy and complete the probability tree diagram below. [3 marks]



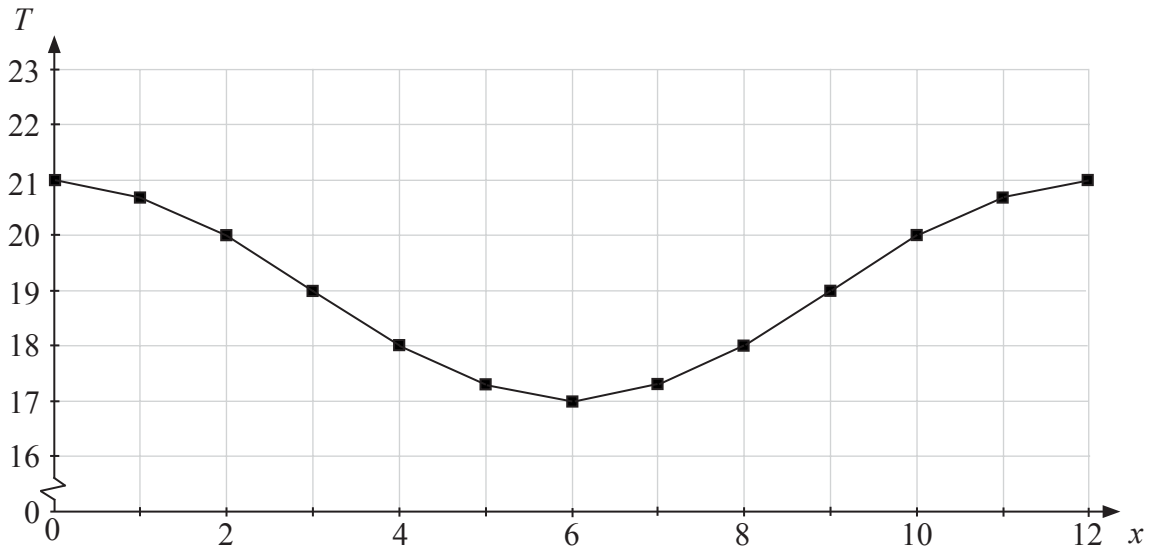
- (b) Calculate the probability that
 - (i) Kate goes to the cinema and is not late; [2 marks]
 - (ii) the person who goes to the cinema arrives home late. [3 marks]

3. [Maximum mark: 13]

- (i) The graph below represents the temperature (T° Celsius) in Washington measured at midday during a period of thirteen consecutive days starting at Day 0. These points also lie on the graph of the function

$$T(x) = a + b\cos(cx^\circ), \quad 0 \leq x \leq 12,$$

where a, b and $c \in \mathbb{R}$.



- (a) Find the value of
- (i) a ;
 - (ii) b . [2 marks]
- (b) Show that $c = 30$. [1 mark]
- (c) Using the graph, or otherwise, write down the part of the domain for which the midday temperature is less than 18.5° . [2 marks]

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(Question 3 continued)

- (ii) The number of bottles of water sold at a railway station on each day is given in the following table.

Day	0	1	2	3	4	5	6	7	8	9	10	11	12
Temperature (T°)	21	20.7	20	19	18	17.3	17	17.3	18	19	20	20.7	21
Number of bottles sold (n)	150	141	126	125	98	101	93	99	116	121	119	134	141

- (a) Write down
- (i) the mean temperature;
 - (ii) the standard deviation of the temperatures. *[2 marks]*
- (b) Write down the correlation coefficient, r , for the variables n and T . *[1 mark]*
- (c) Comment on your value for r . *[2 marks]*
- (d) The equation of the line of regression for n on T is $n = dT - 100$.
- (i) Write down the value of d .
 - (ii) Estimate how many bottles of water will be sold when the temperature is 19.6° . *[2 marks]*
- (e) On a day when the temperature was 36° Peter calculates that 314 bottles would be sold. Give one reason why his answer might be unreliable. *[1 mark]*

4. [Maximum mark: 19]

(i) Mal is shopping for a school trip. He buys 50 tins of beans and 20 packets of cereal. The total cost is 260 Australian dollars (AUD).

(a) Write down an equation showing this information, taking b to be the cost of one tin of beans and c to be the cost of one packet of cereal in AUD. [1 mark]

Stephen thinks that Mal has not bought enough so he buys 12 more tins of beans and 6 more packets of cereal. He pays 66 AUD.

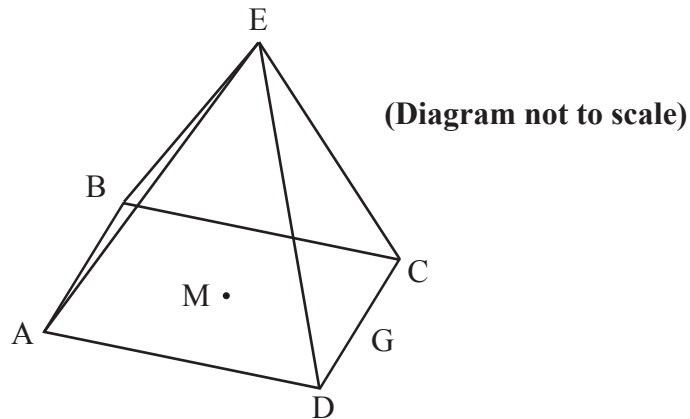
(b) Write down another equation to represent this information. [1 mark]

(c) Find the cost of one tin of beans. [2 marks]

(d) (i) Sketch the graphs of these two equations.

(ii) Write down the coordinates of the point of intersection of the two graphs. [4 marks]

(ii) The triangular faces of a square based pyramid, ABCDE, are all inclined at 70° to the base. The edges of the base ABCD are all 10 cm and M is the centre. G is the mid-point of CD.



(a) Using the letters on the diagram draw a triangle showing the position of a 70° angle. [1 mark]

(b) Show that the height of the pyramid is 13.7 cm, to 3 significant figures. [2 marks]

(c) Calculate

(i) the length of EG;

(ii) the size of angle DEC. [4 marks]

(d) Find the total surface area of the pyramid. [2 marks]

(e) Find the volume of the pyramid. [2 marks]

5. [Maximum mark: 21]

(i) (a) Factorise $3x^2 + 13x - 10$. [2 marks]

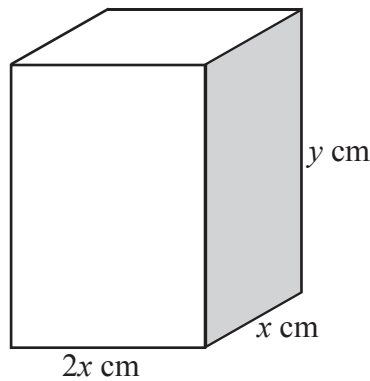
(b) Solve the equation $3x^2 + 13x - 10 = 0$. [2 marks]

Consider a function $f(x) = 3x^2 + 13x - 10$.

(c) Find the equation of the axis of symmetry on the graph of this function. [2 marks]

(d) Calculate the minimum value of this function. [2 marks]

(ii) A closed rectangular box has a height y cm and width x cm. Its length is twice its width. It has a fixed outer surface area of 300 cm^2 .



(a) Show that $4x^2 + 6xy = 300$. [2 marks]

(b) Find an expression for y in terms of x . [2 marks]

(c) Hence show that the volume V of the box is given by $V = 100x - \frac{4}{3}x^3$. [2 marks]

(d) Find $\frac{dV}{dx}$. [2 marks]

(e) (i) Hence find the value of x and of y required to make the volume of the box a maximum.

(ii) Calculate the maximum volume. [5 marks]