



MATHEMATICS STANDARD LEVEL PAPER 2

Friday 5 November 2010 (morning)

1	hour	30	min	LITAC
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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.
- Section A: answer all of Section A in the spaces provided.
- Section B: answer all of Section B on the answer sheets provided. Write your session number
 on each answer sheet, and attach them to this examination paper and your cover
 sheet using the tag provided.
- At the end of the examination, indicate the number of sheets used in the appropriate box on your cover sheet.
- Unless otherwise stated in the question, all numerical answers must be given exactly or correct to three significant figures.

Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. In particular, 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. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

SECTION A

Answer **all** the questions in the spaces provided. Working may be continued below the lines, if necessary.

1. [Maximum mark: 6]

A standard die is rolled 36 times. The results are shown in the following table.

Score	1	2	3	4	5	6
Frequency	3	5	4	6	10	8

(a)	Write down the standard deviation.	[2 marks]
(b)	Write down the median score.	[1 mark]
(c)	Find the interquartile range.	[3 marks]

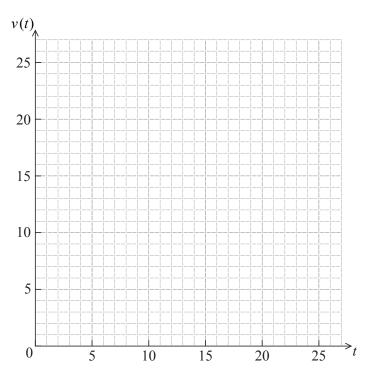


2. [Maximum mark: 7]

The velocity $v \text{ m s}^{-1}$ of an object after t seconds is given by $v(t) = 15\sqrt{t} - 3t$, for $0 \le t \le 25$.

(a) On the grid below, sketch the graph of v, clearly indicating the maximum point.

[3 marks]



Let *d* be the distance travelled in the first nine seconds.

Hence, write down the value of d.

(b) (i) Write down an expression for d.

(ii)

[4 marks]

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3.	[Ma	ximun	n mark: 6]	
	The	n th ter	m of an arithmetic sequence is given by $u_n = 5 + 2n$.	
	(a)	Writ	te down the common difference.	[1 mark]
	(b)	(i)	Given that the n^{th} term of this sequence is 115, find the value of n .	
		(ii)	For this value of n , find the sum of the sequence.	[5 marks]

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[Maximum mark: 7] 4.

1	(2))	(k)		
Let $v =$	-3	and $w =$	-2	, for $k > 0$. The angle between v and w is	$\frac{\pi}{2}$
į	6		4		3

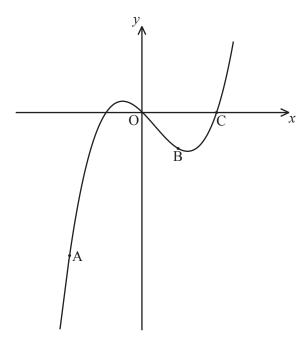
Find the value of k.

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[4 marks]

5. [Maximum mark: 7]

Consider the function $f(x) = px^3 + qx^2 + rx$. Part of the graph of f is shown below.



The graph passes through the origin O and the points A(-2, -8), B(1, -2) and C(2, 0).

Find three linear equations in p, q and r.

(b) Hence find the value of p, of q and of r. [3 marks]

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(a)

6. [Maximum mark: 7]

The following diagram shows the triangle ABC.

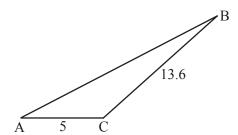


diagram not to scale

The angle at C is obtuse, AC = 5 cm, BC = 13.6 cm and the area is 20 cm².

(a)	Find AĈB.	[4 marks]
(b)	Find AB.	[3 marks]

7. [Maximum mark: 5]

Let
$$f'(x) = -24x^3 + 9x^2 + 3x + 1$$
.

(a) There are two points of inflexion on the graph of f. Write down the x-coordinates of these points.

[3 marks]

(b) Let g(x) = f''(x). Explain why the graph of g has no points of inflexion.

[2 marks]

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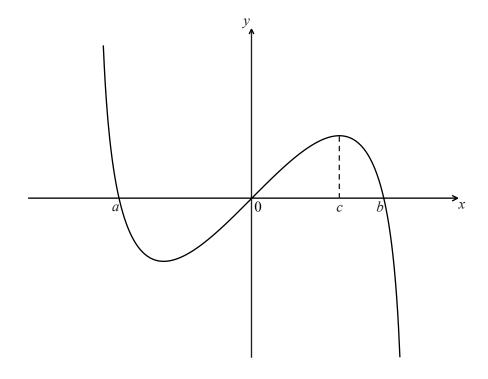
Do **NOT** write solutions on this page. Any working on this page will **NOT** be marked.

SECTION B

Answer all the questions on the answer sheets provided. Please start each question on a new page.

8. [Maximum mark: 12]

Let $f(x) = x \ln(4-x^2)$, for -2 < x < 2. The graph of f is shown below.



The graph of f crosses the x-axis at x = a, x = 0 and x = b.

(a) Find the value of a and of b.

[3 marks]

The graph of f has a maximum value when x = c.

(b) Find the value of c.

[2 marks]

(c) The region under the graph of f from x = 0 to x = c is rotated 360° about the x-axis. Find the volume of the solid formed.

[3 marks]

(d) Let R be the region enclosed by the curve, the x-axis and the line x = c, between x = a and x = c.

Find the area of R.

[4 marks]

Do **NOT** write solutions on this page. Any working on this page will **NOT** be marked.

9. [Maximum mark: 17]

A test has five questions. To pass the test, at least three of the questions must be answered correctly.

The probability that Mark answers a question correctly is $\frac{1}{5}$. Let X be the number of questions that Mark answers correctly.

- (a) (i) Find E(X).
 - (ii) Find the probability that Mark passes the test.

[6 marks]

Bill also takes the test. Let Y be the number of questions that Bill answers correctly. The following table is the probability distribution for Y.

У	0	1	2	3	4	5
P(Y=y)	0.67	0.05	a+2b	a-b	2a+b	0.04

- (b) (i) Show that 4a + 2b = 0.24.
 - (ii) Given that E(Y) = 1, find a and b.

[8 marks]

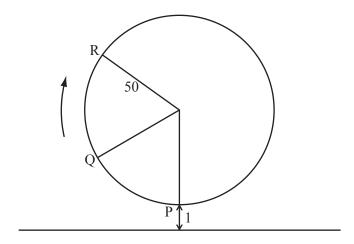
(c) Find which student is more likely to pass the test.

[3 marks]

Do NOT write solutions on this page. Any working on this page will NOT be marked.

10. [Maximum mark: 16]

The following diagram represents a large Ferris wheel at an amusement park. The points P, Q and R represent different positions of a seat on the wheel.



The wheel has a radius of 50 metres and rotates clockwise at a rate of one revolution every 30 minutes.

A seat starts at the lowest point P, when its height is one metre above the ground.

(a) Find the height of a seat above the ground after 15 minutes. [2 marks]

(b) After six minutes, the seat is at point Q. Find its height above the ground at Q. [5 marks]

The height of the seat above ground after t minutes can be modelled by the function $h(t) = 50\sin(b(t-c)) + 51$.

(c) Find the value of b and of c. [6 marks]

(d) Hence find the value of t the first time the seat is 96 m above the ground. [3 marks]