

**Mathematics**  
**Standard level**  
**Paper 2**

Wednesday 13 May 2015 (afternoon)

Candidate session number

1 hour 30 minutes

--	--	--	--	--	--	--	--	--	--

**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 questions in the boxes provided.
- Section B: answer all questions in the answer booklet provided. Fill in your session number on the front of the answer booklet, and attach it to this examination paper and your cover sheet using the tag provided.
- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
- A clean copy of the **Mathematics SL formula booklet** is required for this paper.
- The maximum mark for this examination paper is **[90 marks]**.









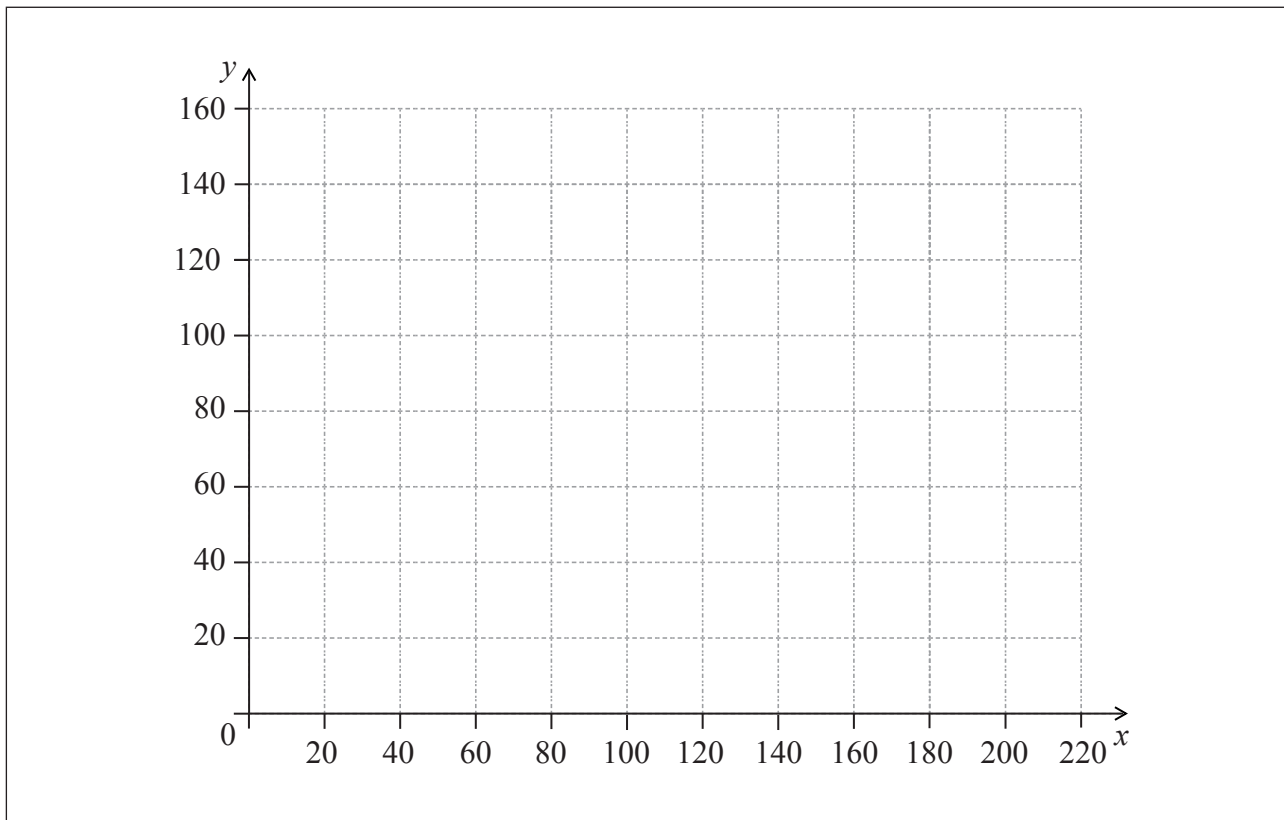


5. [Maximum mark: 6]

Let  $G(x) = 95e^{(-0.02x)} + 40$ , for  $20 \leq x \leq 200$ .

(a) On the following grid, sketch the graph of  $G$ .

[3]



(b) Robin and Pat are planning a wedding banquet. The cost per guest,  $G$  dollars, is modelled by the function  $G(n) = 95e^{(-0.02n)} + 40$ , for  $20 \leq n \leq 200$ , where  $n$  is the number of guests.

Calculate the **total** cost for 45 guests.

[3]

(This question continues on the following page)





6. [Maximum mark: 7]

Let  $f(x) = \frac{\ln(4x)}{x}$ , for  $0 < x \leq 5$ .

Points P(0.25, 0) and Q are on the curve of  $f$ . The tangent to the curve of  $f$  at P is perpendicular to the tangent at Q. Find the coordinates of Q.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

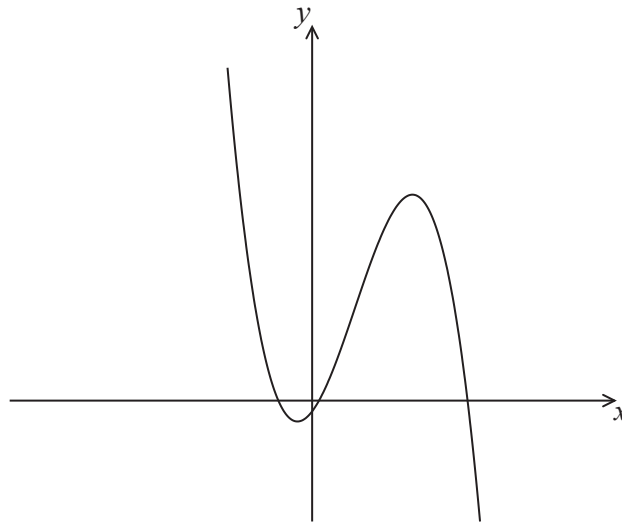
.....





7. [Maximum mark: 7]

The following diagram shows part of the graph of  $f(x) = -2x^3 + 5.1x^2 + 3.6x - 0.4$ .



(a) Find the coordinates of the local minimum point. [2]

(b) The graph of  $f$  is translated to the graph of  $g$  by the vector  $\begin{pmatrix} 0 \\ k \end{pmatrix}$ . Find all values of  $k$  so that  $g(x) = 0$  has exactly one solution. [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



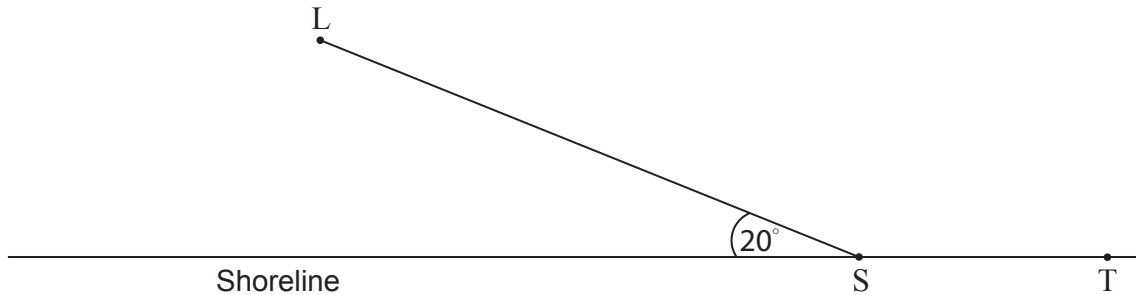
Do **not** write solutions on this page.

### Section B

Answer **all** questions in the answer booklet provided. Please start each question on a new page.

8. [Maximum mark: 13]

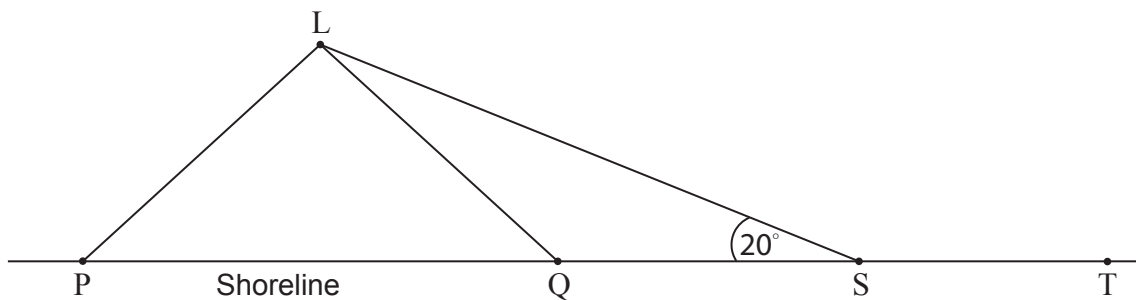
The following diagram shows a straight shoreline, with a supply store at S, a town at T, and an island L.



A boat delivers supplies to the island. The boat leaves S, and sails to the island. Its path makes an angle of  $20^\circ$  with the shoreline.

(a) The boat sails at 6 km per hour, and arrives at L after 1.5 hours. Find the distance from S to L. [2]

It is decided to change the position of the supply store, so that its distance from L is 5 km. The following diagram shows the two possible locations P and Q for the supply store.



(b) Find the size of  $\hat{SPL}$  and of  $\hat{SQL}$ . [5]

(c) The town wants the new supply store to be as near as possible to the town.

(i) State which of the points P or Q is chosen for the new supply store.

(ii) Hence find the distance between the old supply store and the new one. [6]



Do **not** write solutions on this page.

9. [Maximum mark: 16]

A company makes containers of yogurt. The volume of yogurt in the containers is normally distributed with a mean of 260 ml and standard deviation of 6 ml.

A container which contains less than 250 ml of yogurt is **underfilled**.

(a) A container is chosen at random. Find the probability that it is underfilled. [2]

The company decides that the probability of a container being underfilled should be reduced to 0.02. It decreases the standard deviation to  $\sigma$  and leaves the mean unchanged.

(b) Find  $\sigma$ . [4]

The company changes to the new standard deviation,  $\sigma$ , and leaves the mean unchanged. A container is chosen at random for inspection. It passes inspection if its volume of yogurt is between 250 and 271 ml.

(c) (i) Find the probability that it passes inspection.  
(ii) Given that the container is **not** underfilled, find the probability that it passes inspection. [6]

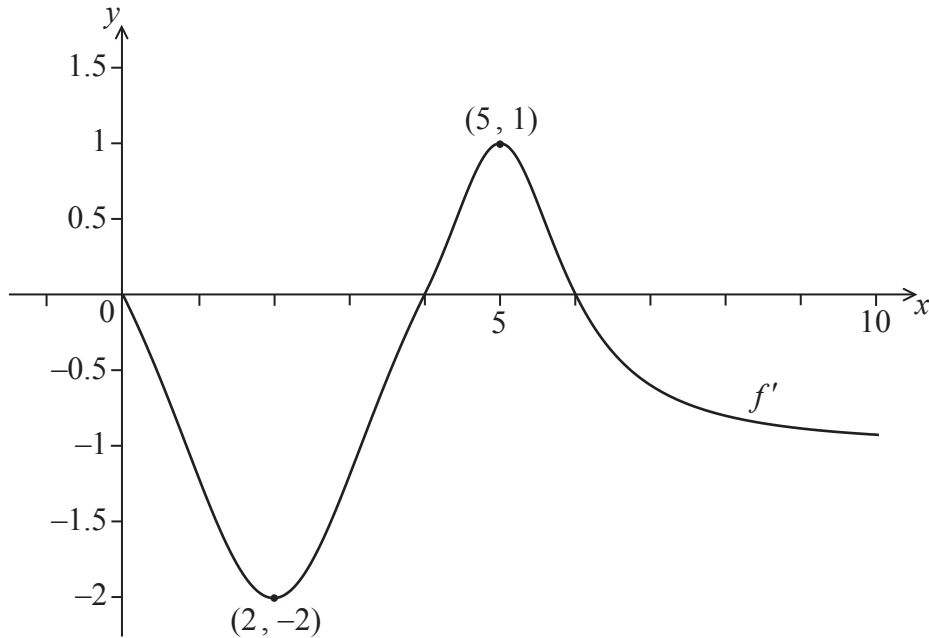
(d) A sample of 50 containers is chosen at random. Find the probability that 48 or more of the containers pass inspection. [4]



Do **not** write solutions on this page.

10. [Maximum mark: 16]

Consider a function  $f$ , for  $0 \leq x \leq 10$ . The following diagram shows the graph of  $f'$ , the derivative of  $f$ .



The graph of  $f'$  passes through  $(2, -2)$  and  $(5, 1)$ , and has  $x$ -intercepts at 0, 4 and 6.

(a) The graph of  $f$  has a local maximum point when  $x = p$ . State the value of  $p$ , and justify your answer. [3]

(b) Write down  $f'(2)$ . [1]

Let  $g(x) = \ln(f(x))$  and  $f(2) = 3$ .

(c) Find  $g'(2)$ . [4]

(d) Verify that  $\ln 3 + \int_2^a g'(x) dx = g(a)$ , where  $0 \leq a \leq 10$ . [4]

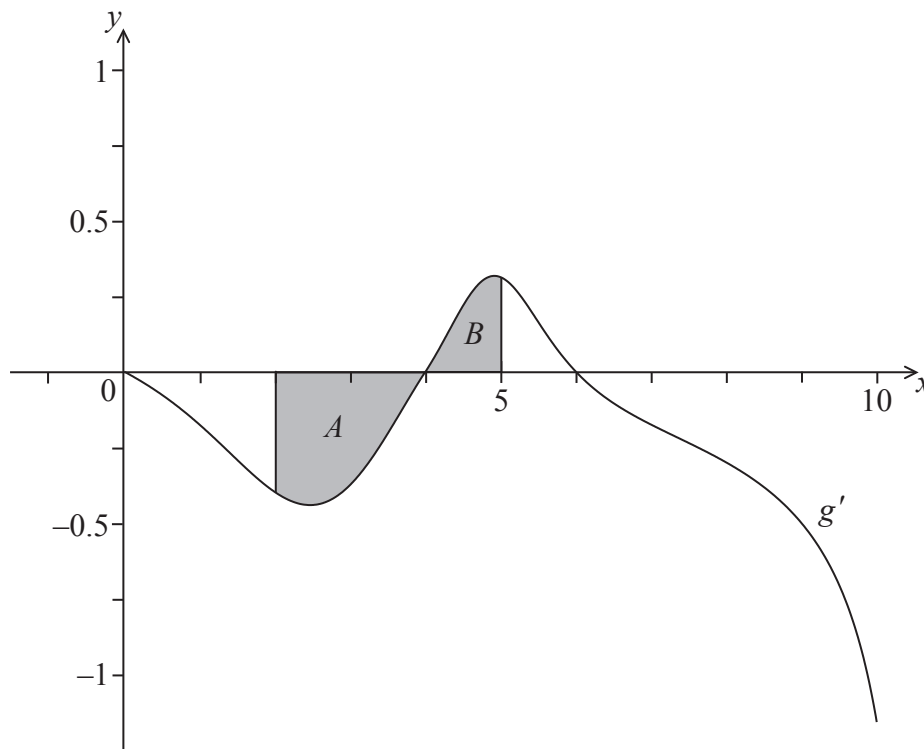
(This question continues on the following page)



Do **not** write solutions on this page.

**(Question 10 continued)**

(e) The following diagram shows the graph of  $g'$ , the derivative of  $g$ .



The shaded region  $A$  is enclosed by the curve, the  $x$ -axis and the line  $x = 2$ , and has area  $0.66 \text{ units}^2$ .

The shaded region  $B$  is enclosed by the curve, the  $x$ -axis and the line  $x = 5$ , and has area  $0.21 \text{ units}^2$ .

Find  $g(5)$ .

[4]



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

Answers written on this page  
will not be marked.



16EP14

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

Answers written on this page  
will not be marked.



16EP15

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

Answers written on this page  
will not be marked.



16EP16