



88117302



MATHEMATICS
STANDARD LEVEL
PAPER 2

Candidate session number

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Thursday 3 November 2011 (morning)

Examination code

1 hour 30 minutes

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INSTRUCTIONS TO CANDIDATES

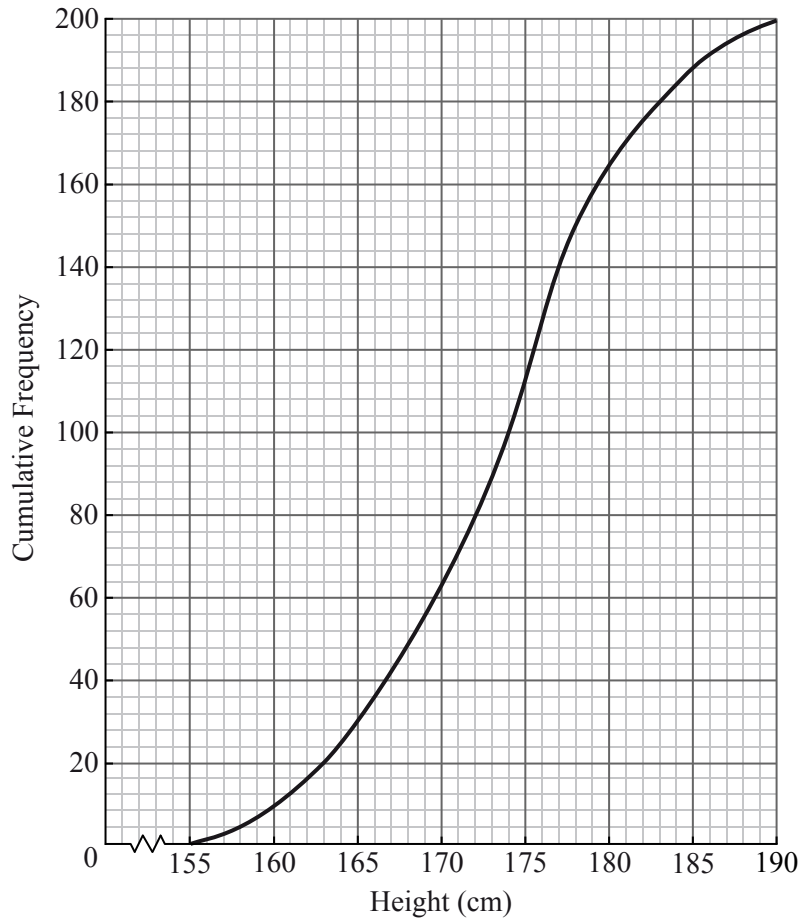
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- A graphic display calculator is required for this paper.
- Section A: answer all questions in the boxes provided.
- Section B: answer all questions on the answer sheets provided. Write your 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 should be given exactly or correct to three significant figures.



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2. [Maximum mark: 6]

The cumulative frequency curve below represents the heights of 200 sixteen-year-old boys.



Use the graph to answer the following.

- (a) Write down the median value. [1 mark]
- (b) A boy is chosen at random. Find the probability that he is shorter than 161 cm. [2 marks]
- (c) Given that 82 % of the boys are taller than h cm, find h . [3 marks]

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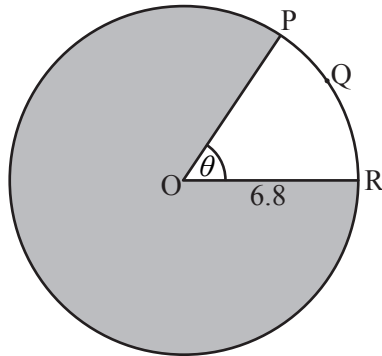
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3. [Maximum mark: 6]

Consider the following circle with centre O and radius 6.8 cm.



*diagram
not to scale*

The length of the arc PQR is 8.5 cm.

- (a) Find the value of θ . [2 marks]
- (b) Find the area of the shaded region. [4 marks]

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4. [Maximum mark: 6]

Consider the triangle ABC, where $AB = 10$, $BC = 7$ and $\hat{CAB} = 30^\circ$.

(a) Find the two possible values of \hat{ACB} . [4 marks]

(b) Hence, find \hat{ABC} , given that it is acute. [2 marks]

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5. [Maximum mark: 5]

Consider the expansion of $(3x^2 + 2)^9$.

(a) Write down the number of terms in the expansion.

[1 mark]

(b) Find the term in x^4 .

[4 marks]

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6. [Maximum mark: 8]

Jose takes medication. After t minutes, the concentration of medication left in his bloodstream is given by $A(t) = 10(0.5)^{0.014t}$, where A is in milligrams per litre.

- (a) Write down $A(0)$. [1 mark]
- (b) Find the concentration of medication left in his bloodstream after 50 minutes. [2 marks]
- (c) At 13:00, when there is no medication in Jose's bloodstream, he takes his first dose of medication. He can take his medication again when the concentration of medication reaches 0.395 milligrams per litre. What time will Jose be able to take his medication again? [5 marks]

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SECTION B

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

8. [Maximum mark: 14]

(a) Consider an infinite geometric sequence with $u_1 = 40$ and $r = \frac{1}{2}$.

(i) Find u_4 .

(ii) Find the sum of the infinite sequence.

[4 marks]

Consider an arithmetic sequence with n terms, with first term (-36) and eighth term (-8) .

(b) (i) Find the common difference.

(ii) Show that $S_n = 2n^2 - 38n$.

[5 marks]

(c) The sum of the infinite geometric sequence is equal to twice the sum of the arithmetic sequence. Find n .

[5 marks]



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9. [Maximum mark: 16]

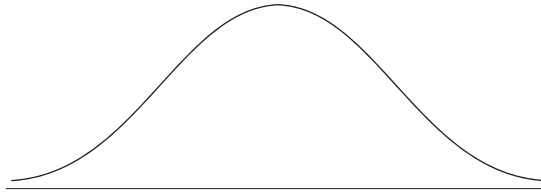
A company produces a large number of water containers. Each container has two parts, a bottle and a cap. The bottles and caps are tested to check that they are not defective.

A cap has a probability of 0.012 of being defective. A random sample of 10 caps is selected for inspection.

- (a) Find the probability that exactly one cap in the sample will be defective. [2 marks]
- (b) The sample of caps passes inspection if at most one cap is defective. Find the probability that the sample passes inspection. [2 marks]

The heights of the bottles are normally distributed with a mean of 22 cm and a standard deviation of 0.3 cm.

- (c) (i) **Copy** and complete the following diagram, shading the region representing where the heights are less than 22.63 cm.



- (ii) Find the probability that the height of a bottle is less than 22.63 cm. [5 marks]
- (d) (i) A bottle is accepted if its height lies between 21.37 cm and 22.63 cm. Find the probability that a bottle selected at random is accepted.
- (ii) A sample of 10 bottles passes inspection if all of the bottles in the sample are accepted. Find the probability that the sample passes inspection. [5 marks]
- (e) The bottles and caps are manufactured separately. A sample of 10 bottles and a sample of 10 caps are randomly selected for testing. Find the probability that both samples pass inspection. [2 marks]



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

10. [Maximum mark: 15]

Let $f(x) = \frac{20x}{e^{0.3x}}$, for $0 \leq x \leq 20$.

- (a) Sketch the graph of f . [3 marks]
- (b) (i) Write down the x -coordinate of the maximum point on the graph of f .
- (ii) Write down the interval where f is increasing. [3 marks]
- (c) Show that $f'(x) = \frac{20 - 6x}{e^{0.3x}}$. [5 marks]
- (d) Find the interval where the rate of change of f is increasing. [4 marks]
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Answers written on this page will
not be marked.



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