

Mathematics Advanced

Mini Mock Examination

Reading time - 2 minutes

Working time - 36 minutes

General Instructions

- Answer all questions.
- Calculators approved by NESA may be used.
- Show relevant mathematical reasoning and calculations in Section II.
- A reference sheet may be used where relevant.

Total marks: 20

Section I - 5 marks

- Attempt Questions 1-5
- Allow about 9 minutes for this section.

Section II - 15 marks

- Attempt Questions 6-10
- Allow about 27 minutes for this section.

Student name: _____

Date attempted: _____

Score: _____ / 20

Section I

5 marks

Attempt Questions 1-5

Allow about 9 minutes for this section

Select the best answer for each question.

Question 1 (1 mark)

The lengths of screws produced by a machine are normally distributed with a mean of 40 mm.

If 84% of values are less than 41.8 mm, then the standard deviation of the distribution to one decimal place is

- A. 2.8
- B. 1.8
- C. 3.3
- D. 0.8

Question 2 (1 mark)

Let $f(x) = e^{9-3x}$. Find $f'(2)$.

- A. $-3e^3$
- B. e^3
- C. $-e^3$
- D. $3e^3$

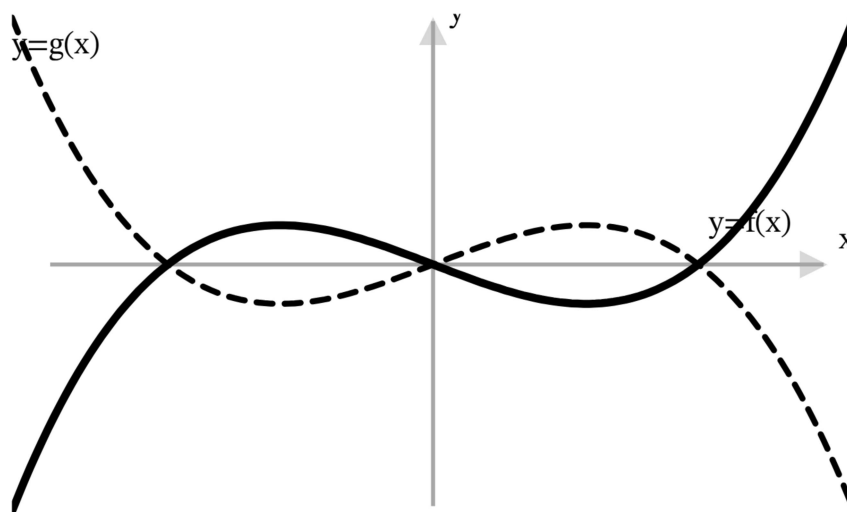
Question 3 (1 mark)

Find the domain of $f(x) = \sqrt{-2x^2 + 4}$.

- A. $[-\sqrt{2}, \sqrt{2}]$
- B. $(-\infty, -\sqrt{2}] \cup [\sqrt{2}, \infty)$
- C. $\mathbb{R}$
- D. $(-\sqrt{2}, \sqrt{2})$

Question 4 (1 mark)

The graph shows two cubic functions $y = f(x)$ and $y = g(x)$.



It is given that $f(x)$ is an odd function and that

$$g(x) = f(-x).$$

Define

$$h(x) = f(x) - g(x).$$

How many stationary points does $y = h(x)$ have?

- A. 1
- B. 2
- C. 0
- D. 3

Question 5 (1 mark)

For what values of k does the equation

$$2x^2 + x + (4k - 5) = 0$$

have no real roots?

- A. $k < \frac{41}{32}$
- B. $k \geq \frac{41}{32}$
- C. $k > \frac{41}{32}$
- D. $k \leq \frac{41}{32}$

End of Section I

Section II

15 marks

Attempt Questions 6-10

Allow about 27 minutes for this section

Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response. Your responses should include relevant mathematical reasoning and calculations.

Question 6 (3 marks)

Solve the equation

3

$$\frac{\operatorname{cosec} x}{5} - 2 = 0$$

for

$$0^\circ \leq x \leq 360^\circ,$$

correct to the nearest degree.

If there is more than one solution, separate answers with commas.

Round to 2 decimal places where appropriate.

Question 7 (2 marks)

For the arithmetic progression $4, 7, 10, \dots$, how many terms must be taken for the sum to exceed 1065? **2**

Question 8 (2 marks)

A sports team may win or lose a match. If it rains, the probability that the team wins is 20%. If it does not rain, the probability that the team wins is 50%. The probability that it rains is 50%.

Given that the team loses, find the probability that it rained. Give your answer to 2 decimal places. **2**

Question 9 (2 marks)

Let X represent the proportion of a homework session spent on written working. The probability density function of X is

$$f(x) = \begin{cases} 2x, & 0 \leq x \leq 1, \\ 0, & \text{otherwise.} \end{cases}$$

Find $E(X)$.

2

Round to 2 decimal places where appropriate.

Question 10 (6 marks)

A 24-centimetre length of wire is cut into three pieces. Two pieces are bent to form two congruent circles and the final piece is bent to form a square.

- (i) If the radius of each congruent circle is r centimetres, show that the total area of the three shapes is **2**

$$A = (6 - \pi r)^2 + 2\pi r^2.$$

- (ii) Hence, find the side length s of the square and the value of r that minimise the total area. **4**

Round to 2 decimal places where appropriate.

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End of Examination