THE SCHOOL FOR EXCELLENCE (TSFX)

UNIT 4 MATHEMATICAL METHODS 2008

WRITTEN EXAMINATION 1

Reading Time: 15 minutes
Writing time: 1 hour

QUESTION AND ANSWER BOOKLET

Structure of Booklet

Number of questions	Number of questions to be answered	Number of marks
10	10	40

Students are permitted to bring into the examination rooms: pens, pencils, highlighters, erasers, sharpeners, rulers.

Students are **NOT** permitted to bring into the examination room: notes of any kind, a calculator, blank sheets of paper and/or white out liquid/tape.

Students are **NOT** permitted to bring mobile phones and/or any electronic communication devices into the examination room.

All written responses must be in English.

COMPLIMENTS OF THE SCHOOL FOR EXCELLENCE

Voted Number One For Excellence and Quality in VCE Programs and Tutorials.

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Instructions

- Answer **all** questions in the spaces provided.
- A decimal approximation will not be accepted if an **exact** answer is required to a question.
- In questions where more than 1 mark is available, appropriate working must be shown.
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

QUESTION 1

Events A and B are such that $\Pr(A) = \frac{1}{2}$, $\Pr(A' \mid B) = \frac{1}{3}$ and $\Pr(A \cup B) = \frac{3}{5}$. Find $\Pr(A \mid B')$.

4 marks

QUESTION 2

(a) Solve $x^4 - 2x^2 - x = 0$.

2 marks

Let $f(x) = x^4 - 2x^2 - x$.

(b) Show that $f'(1) = f'(-1)$.

2 marks

(c) The curve $f(x) = x^4 - 2x^2 - x$ has two points that share a common tangent. Find the equation of this tangent.

2 marks

QUESTION 3

(a) Let $p = \log_b 2$, $q = \log_b 3$ and $r = \log_b 5$.

Write $\log_b\left(\frac{5\sqrt{3}}{2}\right)$ in terms of p, q and/or r.

2 marks

(b) Find the coefficient of x^2 in the expansion of $\left(3x - \frac{4}{x^2}\right)^{14}$ in the form $\binom{14}{a}(9)^b(16)^c$ where a, b and c are whole numbers.

2 marks

QUESTION 4

Find all values of *k* such that the equation $2^x - k\left(2^{-x}\right) = 1$ has exactly one real solution.

4 marks

QUESTION 5

(a) Find the derivative of $x \log_e x$.

1 mark

(b) Hence find the exact value of a, $0 < a < 1$, such that $\int_a^2 \left| \log_e x \right| dx = \log_e (2\sqrt{2}) - \frac{1}{2}$.

4 marks

QUESTION 6

Write $\cos A \sin\left(\frac{\pi}{2} - A\right) + \cos\left(\frac{3\pi}{2} - A\right)\sin A$ in the form $a\cos^2 A + b$. Hence state the value of a and b.

3 marks

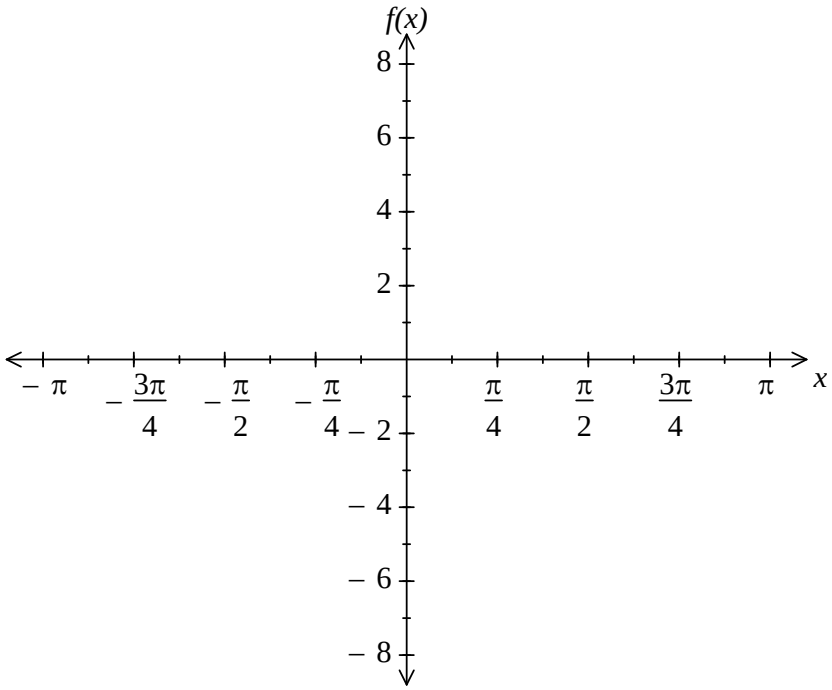
QUESTION 7

For the function $f:(-\infty, 0] \to R$ where $f(t) = \dfrac{2t-6}{2t^2 - t + 3}$, find the rule describing the inverse function.

3 marks

QUESTION 8

Sketch the graph of the function $f:(-\pi,\pi)\to R$ with rule $f(x)=\tan\left(\frac{\pi}{4}-\frac{x}{2}\right)$ on the set of axes below. Label all axes intercepts with their coordinates and state the equations of all asymptotes.



3 marks

QUESTION 9

Air is being pumped into a spherical balloon such that its radius increases at a rate of $0 \cdot 75 \ \ cm/\min$. Find its radius when the rate of change of its volume is $75\pi \ \ cm^3/\min$.

3 marks

QUESTION 10

(a) The function $f(x)$ is described by the rule $f(x) = \dfrac{\cos x}{e^{2x}}$. Find $f'(x)$.

2 marks

(b) Use calculus to find the approximate change in f when x decreases from 1 to 0.9.

3 marks

END OF QUESTION AND ANSWER BOOK