



THE SCHOOL FOR EXCELLENCE (TSFX)
UNIT 4 SPECIALIST MATHEMATICS 2006

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
8	8	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.

theschoolforexcellence



THE SCHOOL FOR EXCELLENCE (TSFX)

The School For Excellence (**TSFX**) is a private educational institution that provides educational services to Year 11 and 12 students out of school hours. Our services include intense revision courses before examinations, intense weekly tuition classes, study skills lectures, as well as specialised courses that prepare students in advance of each school term.

The educational programs conducted by **TSFX** are widely recognised for providing the highest quality programs in Victoria today. Our programs are the result of 15 years of collaborative effort and expertise from dozens of teachers and schools across the state, ensuring the highest possible quality resources and teaching styles for VCE students.

For additional information, join our complimentary mailing list at www.tsfx.com.au. Alternatively, please call **TSFX** on (03) 9663 3311 during business hours.

FREE VCE RESOURCES AT VCEDGE ONLINE

VCEdge Online is a new educational resource designed to provide students the best opportunities to optimise their Year 11 or 12 scores. **VCEdge Online** members receive over \$300 worth of resources at no charge, including:

- Subject notes and course summaries.
- Sample A+ SACS and SATS.
- Trial examinations with worked solutions.
- Weekly study tips and exam advice (in the weeks leading up to the examinations)
- Two **FREE** tickets into an intense examination strategy lecture (valued at \$200!!!).
- Cheat sheets and formula cards.
- Critical VCE updates.
- Free VCE newsletters.
- Information on upcoming educational events.
- And much, much more!!!

JOIN FREE OF CHARGE AT WWW.TSFX.COM.AU

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.
- Take the acceleration due to gravity to have magnitude $g \text{ m/s}^2$ where $g = 9.8$

QUESTION 1

The points $A(-2, 4)$, $B(6, -2)$, $C(5, 5)$ are the vertices of triangle $\triangle ABC$ and D is the mid-point of AB .

- a. Find $\vec{CD}$.

2 marks

- b.** Hence show that CD is perpendicular to AB .

2 marks

Total 4 marks

QUESTION 2

The region enclosed by the x -axis and the curve with equation $y = x - x^2$ is rotated about the x -axis to form a solid of revolution. Express the volume of this solid as a definite integral and **hence** find the exact volume of this solid.

[illegible]

2 marks

Consider the function f with rule $f(x) = \log_e(2x+4)$.

Consider the function f with rule $f(x) = \log_e(2x+4)$.

-

b. Write, but do not evaluate, a definite integral that gives the area enclosed by $f(x)$ and the coordinate axes.

c. Hence find the exact value of the area enclosed by $f(x)$ and the coordinate axes.

[illegible]

Total 5 marks

QUESTION 4

A particle moves along a curve defined by the position vector $\vec{r} = (4\sin^3 t)\vec{i} + (\cos(2t))\vec{j}$,

where $0 \leq t \leq \frac{\pi}{4}$.

- a.** Write parametric equations for the particle's motion.

1 mark

- b.** Find $\frac{dy}{dx}$ in terms of t .

[illegible]

2 marks

QUESTION 5

Oil is leaking from the bottom of a cylindrical tank with horizontal circular base. At time t minutes the depth of oil in the tank is h metres. It is known that $h = 10$ when $t = 0$ and that $h = 5$ when $t = 40$.

a. Sara assumes that the rate of change of h with respect to t is constant.

(i) Find an expression for h in terms of t under Sara's assumption.

1 mark

(ii) Hence find the exact value of h under Sara's assumption when $t = 60$.

1 mark

-
- This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(ii) Hence find in the form $\frac{a}{\sqrt{b}}$, where a and b are positive integers, the exact value of h under Jame's assumption when $t = 60$.

Total 6 marks

QUESTION 6

Let $u = -2 + 2i$.

- a. If $uw = 4i$, find w in Cartesian form.

2 marks

- b. Express u and w in polar form.

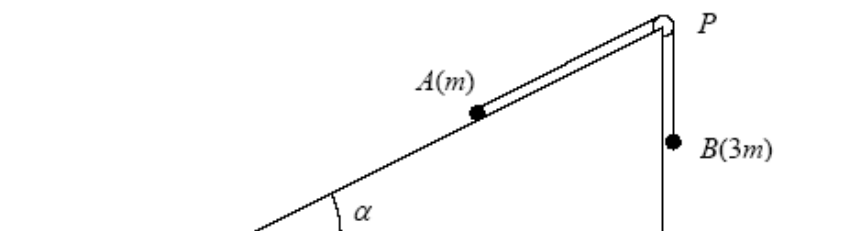
2 marks

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Total 7 marks

QUESTION 7

Two particles A and B of masses m and $3m$ respectively are connected by a light inelastic string that passes over a smooth light pulley P as shown in the diagram. Particle A rests on a rough plane inclined at an angle α to the horizontal, where $\tan(\alpha) = \frac{3}{4}$. Particle B hangs freely below P . The particles are released from rest with the string taut and particle B moves downwards with an acceleration of magnitude $\frac{g}{2}$.



- a. Find the tension in the string.

2 marks

- b.** Find the coefficient of friction between particle *A* and the plane.

[illegible]

3 marks

Total 5 marks

QUESTION 8

Use the substitution $x = \cos t$ to evaluate $\int_0^{\frac{1}{2}} \frac{x^2}{(1-x^2)^{\frac{1}{2}}} dx$.

[illegible]

5 marks

End of Paper