

Year 2005

VCE

Mathematical Methods

Trial Examination 1



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**VICTORIAN CERTIFICATE OF EDUCATION
2005**

MATHEMATICAL METHODS

Trial Written Examination 1 (Facts, skills and applications)

Reading time: 15 minutes
Total writing time: 1 hour 30 minutes

PART I

MULTIPLE-CHOICE QUESTION BOOK

This examination has two parts: Part I (multiple-choice questions) and Part II (short-answer questions).
Part I consists of this question book and must be answered on the answer sheet provided for multiple-choice questions.
Part II consists of a separate question and answer book.
You must complete both parts in the time allotted.
When you have completed one part continue immediately to the other part.

Structure of book

<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
27	27	27

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, a protractor, set-squares, aids for curve sketching, up to four pages (two A4 sheets) of pre-written notes (typed or handwritten) and an approved scientific and/or graphics calculator (memory may be retained).
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.

Materials supplied

- Question book of 20 pages, with a detachable sheet of miscellaneous formulas
- Answer sheet for multiple-choice questions.

Instructions

- Detach the formula sheet during reading time.
- Check that your name and student number as printed on your answer sheet for multiple-choice questions are correct, and sign your name in the space provided to verify this.
- Unless otherwise indicated, the diagrams in this book are not drawn to scale.

At the end of the examination

- Place the answer sheet for multiple-choice questions (Part I) inside the front cover of the question and answer book (Part II).
- You may retain this question book.

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

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VCE MATHEMATICAL METHODS 2005
Trial Written Examination 1
ANSWER SHEET

NAME: _____

STUDENT _____
NUMBER

SIGNATURE _____

Instructions

- Write your name in the space provided above.
- Write your student number in the space provided above. Sign your name.
- Use a **PENCIL** for **ALL** entries.
If you make a mistake, **ERASE** it - **DO NOT** cross it out.
- Marks will **NOT** be deducted for incorrect answers.
- **NO MARK** will be given if more than **ONE** answer is completed for any question.
- All answers must be completed like **THIS** example.

A	B	C	D	E
---	---	---	---	---

1	A	B	C	D	E	15	A	B	C	D	E
2	A	B	C	D	E	16	A	B	C	D	E
3	A	B	C	D	E	17	A	B	C	D	E
4	A	B	C	D	E	18	A	B	C	D	E
5	A	B	C	D	E	19	A	B	C	D	E
6	A	B	C	D	E	20	A	B	C	D	E
7	A	B	C	D	E	21	A	B	C	D	E
8	A	B	C	D	E	22	A	B	C	D	E
9	A	B	C	D	E	23	A	B	C	D	E
10	A	B	C	D	E	24	A	B	C	D	E
11	A	B	C	D	E	25	A	B	C	D	E
12	A	B	C	D	E	26	A	B	C	D	E
13	A	B	C	D	E	27	A	B	C	D	E
14	A	B	C	D	E						

Please DO NOT fold, bend or staple this form

MATHEMATICAL METHODS

Written examinations 1 and 2

FORMULA SHEET

Directions to students

Detach this formula sheet during reading time.

This formula sheet is provided for your reference.

Table 1 Normal distribution – cdf

x	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359	4	8	12	16	20	24	28	32	36
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753	4	8	12	16	20	24	28	32	35
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141	4	8	12	15	19	23	27	31	35
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517	4	8	11	15	19	23	26	30	34
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879	4	7	11	14	18	22	25	29	32
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224	3	7	10	14	17	21	24	27	31
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549	3	6	10	13	16	19	23	26	29
0.7	.7580	.7611	.7642	.7673	.7703	.7734	.7764	.7793	.7823	.7852	3	6	9	12	15	18	21	24	27
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133	3	6	8	11	14	17	19	22	25
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389	3	5	8	10	13	15	18	20	23
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621	2	5	7	9	12	14	16	18	21
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830	2	4	6	8	10	12	14	16	19
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015	2	4	6	7	9	11	13	15	16
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177	2	3	5	6	8	10	11	13	14
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319	1	3	4	6	7	8	10	11	13
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441	1	2	4	5	6	7	8	10	11
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545	1	2	3	4	5	6	7	8	9
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633	1	2	3	3	4	5	6	7	8
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706	1	1	2	3	4	4	5	6	6
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767	1	1	2	2	3	4	4	5	5
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817	0	1	1	2	2	3	3	4	4
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857	0	1	1	2	2	2	3	3	4
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890	0	1	1	1	2	2	2	3	3
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916	0	1	1	1	1	2	2	2	2
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936	0	0	1	1	1	1	1	2	2
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952	0	0	0	1	1	1	1	1	1
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964	0	0	0	0	1	1	1	1	1
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974	0	0	0	0	0	1	1	1	1
2.8	.9974	.9975	.9976	.9977	.9978	.9979	.9980	.9981	.9982	.9983	0	0	0	0	0	0	0	1	1
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986	0	0	0	0	0	0	0	0	0
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990	0	0	0	0	0	0	0	0	0
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993	0	0	0	0	0	0	0	0	0
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995	0	0	0	0	0	0	0	0	0
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997	0	0	0	0	0	0	0	0	0
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998	0	0	0	0	0	0	0	0	0
3.5	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	0	0	0	0	0	0	0	0	0
3.6	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	0	0	0	0	0	0	0	0	0
3.7	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	0	0	0	0	0	0	0	0	0
3.8	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	0	0	0	0	0	0	0	0	0
3.9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0	0	0	0	0	0	0	0	0

END OF FORMULA SHEET

Continuous distributions

normal

If X is distributed $N(\mu, \sigma^2)$ and $Z = \frac{X - \mu}{\sigma}$, then Z is distributed $N(0, 1)$.

Specific Instructions to students

This part consists of 27 questions.

Answer **all** questions in this part on the answer sheet provided for multiple-choice questions.

A correct answer scores 1, an incorrect answer scores 0. No mark will be given for a question if two or more letters are shaded for that question. Marks will not be deducted for incorrect answers. You should attempt every question.

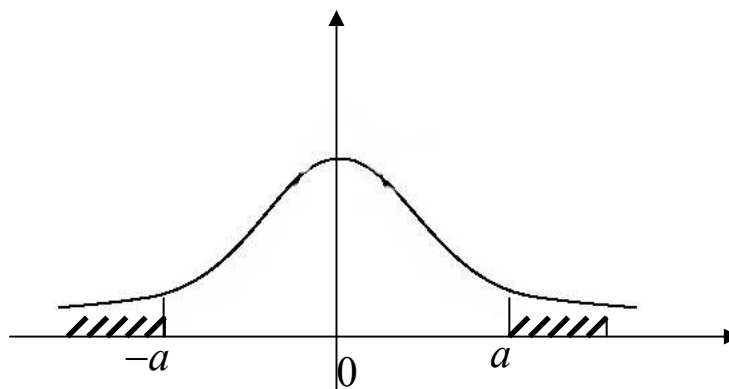
Question 1

The probability of getting the number one to four on a spinner is given in the table below

Number on Spinner	Probability
1	0.1
2	0.4
3	0.2
4	0.3

The probability of getting a 1 or a 4 is

- A. 0.03
- B. 0.3
- C. 0.4
- D. 0.2
- E. 1

Question 2

For the standard normal curve shown above, $\Pr(X < -a) + \Pr(X > a)$ equals

- A. $1 - \Pr(X < a)$
- B. $1 - 2 \Pr(X < a)$
- C. $2 - \Pr(X < a)$
- D. $2 - 2 \Pr(X < a)$
- E. $\Pr(X < a) + \Pr(X < -a)$

Question 3

Six balls are drawn at random without replacement from a box containing 12 balls, four of which are green. The expected number of green balls in the sample is

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

Question 4

A family has five children. The probability the first three children are boys and the two youngest are girls is

- A. $\frac{1}{32}$
- B. $\frac{5}{16}$
- C. $\frac{3}{32}$
- D. $\frac{3}{16}$
- E. $\frac{9}{36}$

Question 5

A box contains ten equal sized and shaped blocks. Six of the blocks are red and the remainder is yellow. Two blocks are drawn from the box without replacement. The probability that the second block is yellow is

A. $\frac{2}{5}$

B. $\frac{3}{5}$

C. $\frac{8}{15}$

D. $\frac{4}{15}$

E. $\frac{2}{15}$

Question 6

The values of x for which $1 \leq 2 \cos\left(\frac{x}{2}\right) \leq \sqrt{3}$, $0 \leq x \leq 2\pi$ are

A. $\{x : \frac{\pi}{6} \leq x \leq \frac{\pi}{3}\} \cup \{x : \frac{5\pi}{6} \leq x \leq 2\pi\}$

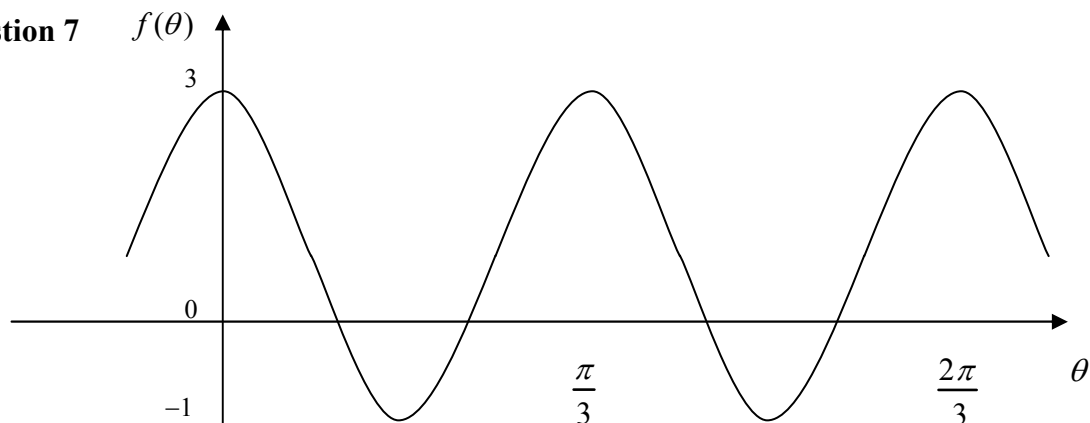
B. $\{x : \frac{5\pi}{6} \leq x \leq 2\pi\}$

C. $\{x : \frac{\pi}{3} \leq x \leq \frac{2\pi}{3}\}$

D. $\{x : \frac{\pi}{6} \leq x \leq \frac{5\pi}{6}\}$

E. $\{x : \frac{\pi}{3} \leq x \leq \frac{5\pi}{3}\}$

Question 7



The equation of the above graph could be

- A. $f(\theta) = 3 \cos(2\theta)$
- B. $f(\theta) = 3 \cos 3(\theta + \frac{\pi}{12})$
- C. $f(\theta) = 2 \sin 3(\theta - \frac{\pi}{12}) + 1$
- D. $f(\theta) = 2 \sin(6\theta) + 1$
- E. $f(\theta) = 2 \cos(6\theta) + 1$

Question 8

The graphs of $2 - 2 \cos^2(\theta)$ and $3 \cos(\theta)$, where $0 \leq \theta \leq 2\pi$, intersect at more than one point.

The sum of the values of θ at these points is

- A. $\frac{\pi}{2}$
- B. $\frac{\pi}{3}$
- C. π
- D. 2π
- E. 3π

Question 9

If $f(x) = x^3 - 2x^2 - 8x - 5$ and $g(x) = f(x - 1)$, then $g(x)$ equals

A. $x^3 - 2x^2 - 8x - 6$

B. $x^3 - 5x^2 - 9x + 4$

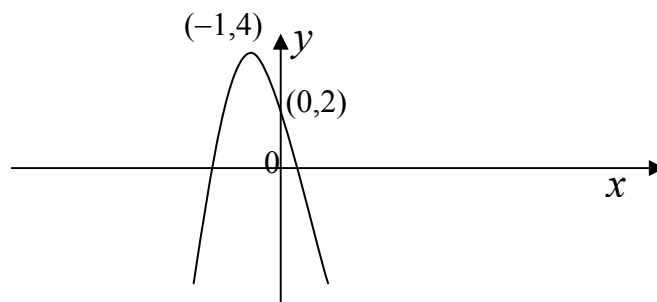
C. $x^3 - 5x^2 + 9x$

D. $x^3 - 5x^2 - 7x$

E. $x^3 - 5x^2 - x$

Question 10

Part of the graph $y = a(x - b)^2 + c$ is shown below



The values of a , b and c respectively could be

	a	b	c
A.	-2	-1	4
B.	-2	1	4
C.	2	1	4
D.	2	4	1
E.	-2	4	1

Question 11

If the graph of $f(x) = e^x$ is translated two units down parallel to the Y axis and then reflected in the X axis to give the graph of $g(x)$, then $g(x)$ could equal

- A. $f(x) + 2$
- B. $f(x) - 2$
- C. $-f(x) + 2$
- D. $-f(x) - 2$
- E. $f(x - 2)$

Question 12

If $f(x) = (x - 1)^2 - 5$, $x \geq 1$, then $f^{-1}(x)$ equals

- A. $1 - \sqrt{x + 5} \quad x \geq -5$
- B. $1 + \sqrt{x + 5} \quad x \geq -5$
- C. $1 \pm \sqrt{x + 5} \quad x \geq -5$
- D. $5 + \sqrt{x + 1} \quad x \geq -1$
- E. $5 + \sqrt{x - 1} \quad x \geq 1$

Question 13

Which one of the following does **not** have an inverse function?

- A. $f(x) = \frac{3}{x^2} \quad (0, \infty)$
- B. $f(x) = \frac{2}{x + 5} \quad x \in \mathbb{R} \setminus \{-5\}$
- C. $f(x) = x^2 - 2x + 6 \quad [1, \infty)$
- D. $f(x) = \tan(x) \quad [0, \pi)$
- E. $f(x) = \pm\sqrt{x - 3} \quad [3, \infty)$

Question 14

If $\log_a(xy^4) = p$ and $\log_a\left(\frac{y^3}{x}\right) = q$, then $\log_a(xy)$ equals

- A. $\frac{1}{7}(3p - 4q)(p + q)$
- B. $\frac{1}{49}(4q - 3p)(p + q)$
- C. $\frac{1}{49}(3p - 4q)(p + q)$
- D. $\frac{4p - 3q}{7}$
- E. $\frac{4q - 3p}{7}$

Question 15

If $\log_8 x = t$, then $\log_2 x$ equals

- A. $2t$
- B. $3t$
- C. $4t$
- D. t^6
- E. t^4

Question 16

Which one of the following is **not** true for $f(x) = 2x^2 - x - 1$

- A. The graph cuts the X axis at the points $(-\frac{1}{2}, 0)$ and $(1, 0)$
- B. $f(x)$ can be written as the product of two real linear factors
- C. $f(x)$ equals $2(x - \frac{1}{4})^2 - \frac{9}{8}$
- D. $f(x)$ is positive for $\{x : -\frac{1}{2} < x < 1\}$
- E. The gradient of $f(x)$ is positive for $\{x : x > \frac{1}{4}\}$

Question 17

The graph of $y = \frac{2x+5}{x+1}$ has

- A. a horizontal asymptote $x = 1$ and a vertical asymptote $y = 3$
- B. a vertical asymptote $x = 1$ and a horizontal asymptote $y = 3$
- C. only one asymptote, $x = -1$
- D. a vertical asymptote $x = -1$ and a horizontal asymptote $y = -2$
- E. a vertical asymptote $x = -1$ and a horizontal asymptote $y = 2$

Question 18

The value of x on the curve $y = e^{5-2x}$ for which the gradient is -8 is

- A. $\frac{5}{2} - \log_e(4)$
- B. $\frac{5}{2} - \log_e(2)$
- C. $\frac{1}{2}(5 - \log_e(2))$
- D. $\frac{1}{2}(5 - \log_e(8))$
- E. $5 - \log_e(8)$

Question 19

The derivative of $\log_e(\cos(2x))$ equals

- A. $-2 \tan(2x)$
- B. $-\frac{\sin(2x)}{\cos(2x)}$
- C. $-\frac{\sin(2x)}{x}$
- D. $-\frac{2 \sin(2x)}{x}$
- E. $-\frac{x}{\cos(2x)}$

Question 20

The values of x for which $(x+4)e^{-2x}$ is an increasing function are

- A. $\{x : x < 4\}$
- B. $\{x : x > 4\}$
- C. $\{x : x < -3\frac{1}{2}\}$
- D. $\{x : x > -3\frac{1}{2}\}$
- E. $\{x : x > 2\}$

Question 21

If $f(x) = \sqrt{3x^2 - 4x + 18}$, then $f'(x)$ equals

- A. $\frac{1}{2\sqrt{3x^2 - 4x + 18}}$
- B. $2\sqrt{3x^2 - 4x + 18}$
- C. $\frac{1}{2}\sqrt{3x^2 - 4x + 18}$
- D. $\frac{6x - 4}{\sqrt{3x^2 - 4x + 18}}$
- E. $\frac{3x - 2}{\sqrt{3x^2 - 4x + 18}}$

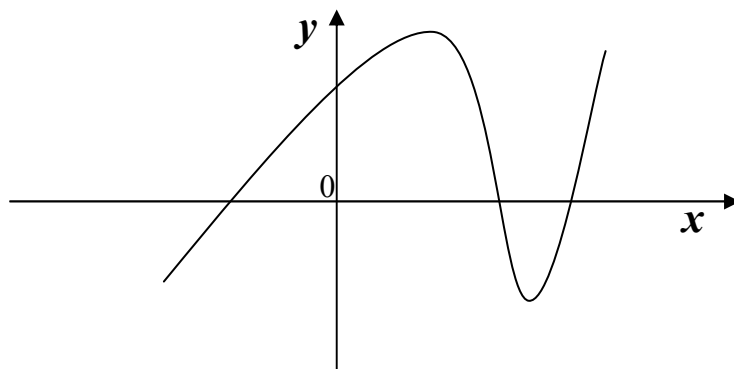
Question 22

Using the approximation formula $f(x+h) \approx f(x) + hf'(x)$, with $f(x) = \sqrt{x}$, an approximate value of $\sqrt{0.98}$ is given by

- A. $f(1) + 0.02f'(1)$
- B. $f(1) - 0.02f'(1)$
- C. $f(1) - 0.98f'(1)$
- D. $f(1) + 0.98f'(1)$
- E. $f(0.98) + 0.02f'(1)$

Question 23

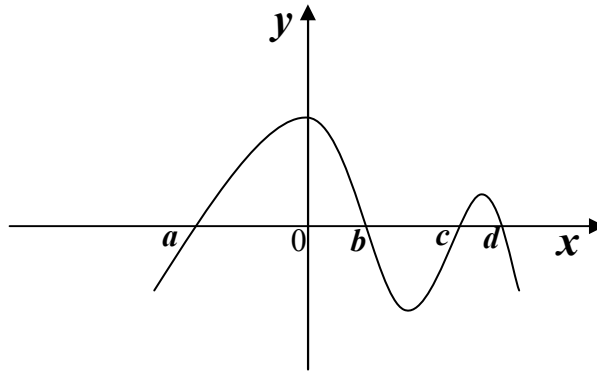
The graph of $y = f(x)$ is shown below



Which one of the following could be the graph of $y = f'(x)$?

A.	B.
C.	D.
E.	

Question 24



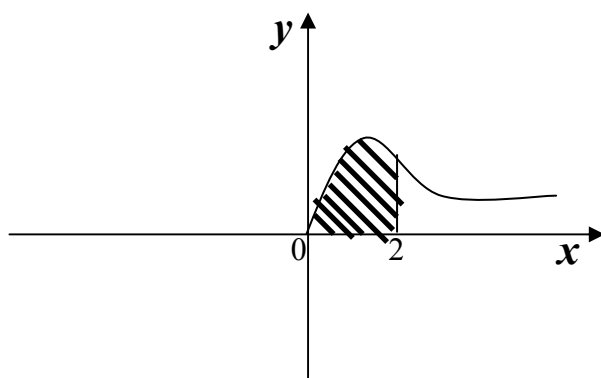
The graph of $y = f(x)$ is shown above. The area bounded by $y = f(x)$ and the X axis in the interval $[a, d]$ could be given by

- A. $\int_a^d f(x)dx$
- B. $\int_a^b f(x)dx + \int_b^c f(x)dx + \int_c^d f(x)dx$
- C. $\int_b^d f(x)dx - \int_a^0 f(x)dx$
- D. $\int_a^b f(x)dx + \int_c^d f(x)dx - \int_c^b f(x)dx$
- E. $\int_a^b f(x)dx + \int_c^d f(x)dx + \int_c^b f(x)dx$

Question 25

The area bounded by the graph $f(x) = \sin(1 - x)$ and the ordinates $x = 0$ and $x = a$, where $f(a) = 0$, $0 < a < \frac{\pi}{2}$, is equal to

- A. $1 - \cos(1)$
- B. $\cos(1) - 1$
- D. $\cos\left(\frac{\pi}{2}\right) - 1$
- D. $1 - \cos\left(\frac{\pi}{2}\right)$
- E. $1 - \cos(\pi - 1)$

Question 26

Part of the graph with equation $y = \frac{kx}{1+x^2}$ where k is a positive constant is shown above. The shaded area can be given by

- A. $kx \int_0^2 \frac{1}{1+x^2} dx$
- B. $k \int_0^2 \frac{1}{1+x} dx$
- E. $k \log_e(1+x^2)$
- D. $2k \log_e(5)$
- E. $\frac{k}{2} \log_e(5)$

Question 27

Given that $\int_0^6 f(x)dx = 5$, where $f(x)$ is a continuous graph and $f(x) > 2, x \in R$

then $\int_0^3 [f(x) - 2]dx + \int_3^6 [f(x) + 1]dx$ equals

- A. 2
- B. 4
- C. 5
- D. 6
- E. 9

**END OF PART I
MULTIPLE CHOICE QUESTION BOOK**

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**VICTORIAN CERTIFICATE OF EDUCATION
2005**

MATHEMATICAL METHODS

Trial Written Examination 1 (Facts, skills and applications)

Reading time: 15 minutes
Total writing time: 1 hour 30 minutes

PART II

QUESTION AND ANSWER BOOK

Structure of book

<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
6	6	23

Specific Instructions to studentsAnswer **all** questions in this part in the spaces provided.**Question 1**

Given $f(x) = \frac{x+1}{x-3}$ can be written in the form $A + \frac{B}{x+C}$

- a.** Find the value of A , B and C

1 mark

- b.** For what values of x is $f(x) > 0$

2 marks

(1 + 2 = 3 marks)

Question 2

A normal distribution has a mean of 60. If 35% of this distribution is less than 50, find the standard deviation to the nearest whole number.

(2 marks)

Question 3

a. Find the exact value/s of x such that $e^{2x} + 4e^x = 12$

(2 marks)

Question 3 (continued)

b. If $\log_e(2x - 8) - \log_e(6) - 2 \log_e(y) = 0$, express y in terms of x .

(2 marks)

c. What is the domain of the function $f(x) = \log_e(2x - 8)$?

(1 mark)

(2 + 2+1 = 5 marks)

Question 4

- a. Find the equation of the tangent to the curve $y = x^2 - 5x + 6$ at the point where $x = 3$

(2 marks)

- b. Find the equation of the normal to the curve at the point where $x = 3$

(1 mark)

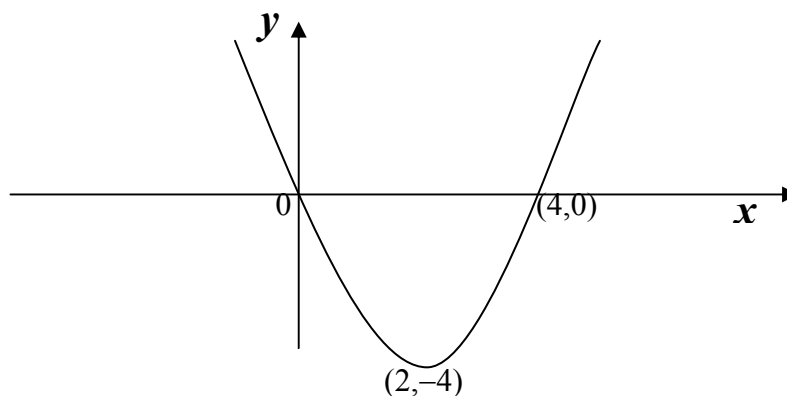
- c. This normal to the point where $x = 3$ cuts the curve $y = x^2 - 5x + 6$ at another point, A .
Find the coordinates of A .

(1 mark)

(2 + 1 + 1 = 4 marks)

Question 5

The graph of $y = f(x)$ is sketched on the axes below.



- a. On the same set of axes, sketch the graph of $y = g(x)$ where $g(x) = -2f(x)$.

Show all relevant points.

(1 mark)

- b. Find the equation of $g(x)$

(1 mark)

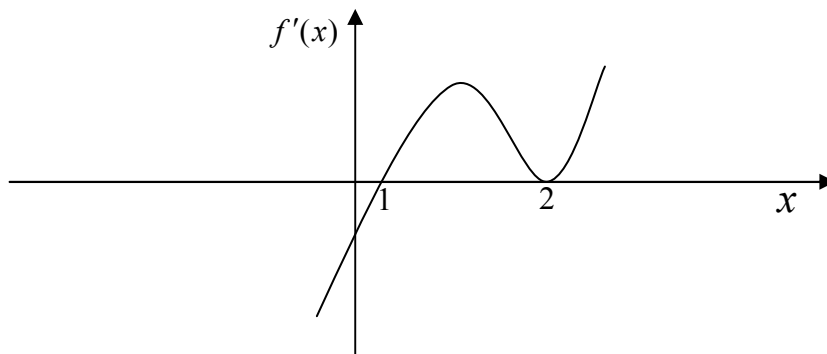
- c. State the transformations required to change $g(x)$ into $h(x)$ where $h(x) = x^2$

(4 marks)

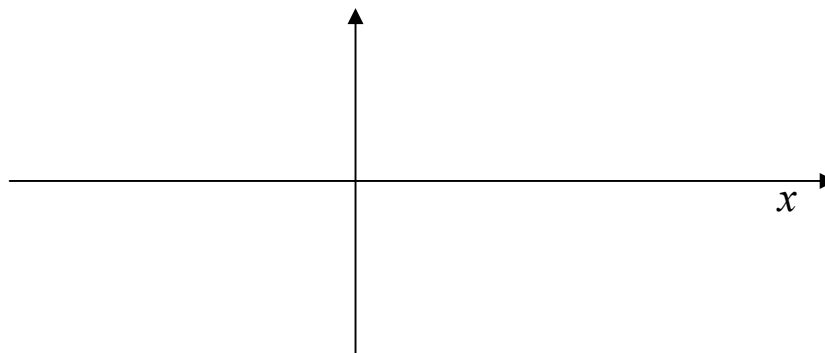
(1 + 1 + 4 = 6 marks)

Question 6

The graph of $y = f'(x)$ is shown below.



Given that $f(0) = 0$ and $f(2) = 0$, sketch the graph of $f(x)$ on the axes below.



(3 marks)

**End of 2005 Mathematical Methods Trial Examination 1
Question and Answer Book**

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