

Year 2004

VCE

Mathematical Methods

Trial Examination 1



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**VICTORIAN CERTIFICATE OF EDUCATION
2004**

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 19 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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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.

Mathematical Methods Formulas

Mensuration

area of a trapezium: $\frac{1}{2}(a+b)h$

curved surface area of a cylinder: $2\pi rh$

volume of a cylinder: $\pi r^2 h$

volume of a cone: $\frac{1}{3}\pi r^2 h$

volume of a pyramid: $\frac{1}{3}Ah$

volume of a sphere: $\frac{4}{3}\pi r^3$

area of a triangle: $\frac{1}{2}bc \sin A$

Calculus

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

$$\frac{d}{dx}(e^{ax}) = ae^{ax}$$

$$\frac{d}{dx}(\log_e x) = \frac{1}{x}$$

$$\frac{d}{dx}(\sin ax) = a \cos ax$$

$$\frac{d}{dx}(\cos ax) = -a \sin ax$$

$$\frac{d}{dx}(\tan ax) = \frac{a}{\cos^2 ax} = a \sec^2 ax$$

$$\int x^n dx = \frac{1}{n+1} x^{n+1} + c, n \neq -1$$

$$\int e^{ax} dx = \frac{1}{a} e^{ax} + c$$

$$\int \frac{1}{x} dx = \log_e x + c, \text{ for } x > 0$$

$$\int \sin ax dx = -\frac{1}{a} \cos ax + c$$

$$\int \cos ax dx = \frac{1}{a} \sin ax + c$$

product rule: $\frac{d}{dx}(uv) = u \frac{dv}{dx} + v \frac{du}{dx}$

chain rule: $\frac{dy}{dx} = \frac{dy}{du} \frac{du}{dx}$

quotient rule: $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$

approximation: $f(x+h) \approx f(x) + hf'(x)$

Statistics and Probability

$$\Pr(A) = 1 - \Pr(A')$$

$$\Pr(A \cup B) = \Pr(A) + \Pr(B) - \Pr(A \cap B)$$

$$\Pr(A|B) = \frac{\Pr(A \cap B)}{\Pr(B)}$$

mean: $\mu = E(X)$

variance: $\text{var}(X) = \sigma^2 = E((X - \mu)^2) = E(X^2) - \mu^2$

Discrete distributions			
	$\Pr(X = x)$	mean	variance
general	$p(x)$	$\mu = \sum x p(x)$	$\sigma^2 = \sum (x - \mu)^2 p(x)$ $= \sum x^2 p(x) - \mu^2$
binomial	${}^n C_x p^x (1-p)^{n-x}$	np	$np(1-p)$
hypergeometric	$\frac{{}^D C_x {}^{N-D} C_{n-x}}{{}^N C_n}$	$n \frac{D}{N}$	$n \frac{D}{N} \left(1 - \frac{D}{N}\right) \frac{N-n}{N-1}$
Continuous distributions			
normal	If X is distributed $N(\mu, \sigma^2)$ and $Z = \frac{X - \mu}{\sigma}$, then Z is distributed $N(0, 1)$.		

Table I 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	.9977	.9978	.9979	.9979	.9980	.9981	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

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

$\frac{2x+2}{x-5}$ equals

A. $2 + \frac{8}{x-5}$

B. $2 - \frac{8}{x-5}$

C. $2 + \frac{12}{x-5}$

D. $2 - \frac{12}{x-5}$

E. $2 - \frac{6}{x+1}$

Question 2

If $x^4 + x^3 + ax^2 + bx + 30$ has a factor $(x+1)$ and another factor $(x-2)$, then the values of a and b are

	a	b
A.	19	11
B.	-19	11
C.	-19	-11
D.	-10	3
E.	3	10

Question 3

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

A. $f(x) = \frac{3}{x-2} \quad x \neq 2$

B. $f(x) = x^3 - x \quad x \in \mathbb{R}$

C. $f(x) = \sin(2x) \quad -\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$

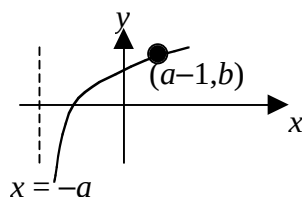
D. $f(x) = e^{-0.5x} \quad x \in \mathbb{R}$

E. $f(x) = 2x - 3 \quad x \in \mathbb{R}$

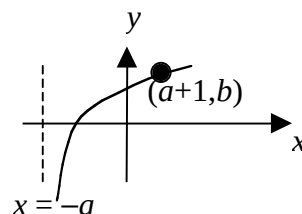
Question 4

Which one of the following is most likely to be the graph of $y = \log_e(x - a) + b$ where a and b are positive real numbers?

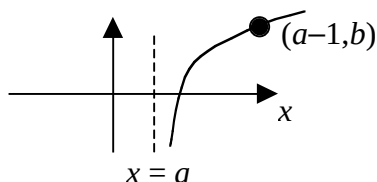
A.



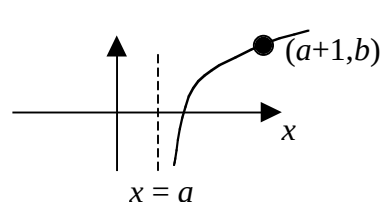
B.



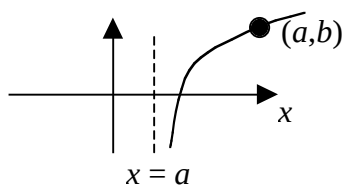
C.



D.



E.



Question 5

The sum of the exact solutions of the equation $\sqrt{3}\sin\left(\frac{3\pi}{2}x\right) = -\cos\left(\frac{3\pi}{2}\right)$ $0 \leq x \leq 2$

A. $\frac{8\pi}{3}$

B. $\frac{11\pi}{3}$

C. $\frac{33\pi}{6}$

D. $\frac{8}{3}$

E. $\frac{11}{3}$

Question 6

If $f(x) = 1 + \sqrt{x}$ then which one of the following statements is true?

A. The domain of $f^{-1}(x)$ is $x \geq 1$

B. $f^{-1}(x) = (x+1)^2$

C. The graphs of $f(x)$ and $f^{-1}(x)$ intersect at the point (1,1)

D. The range of $f^{-1}(x)$ is $x > 1$

E. The range of $f^{-1}(x)$ is $x \leq 1$

Question 7

If the graph of $f(x)$ has a local maximum at $(-1,16)$ and a local minimum at $(3,-16)$, then the graph of $g(x) = f(x-2) + 3$ has

- A. a local maximum at $(-3,19)$ and a local minimum at $(1,-13)$
- B. a local maximum at $(-3,19)$ and a local minimum at $(1,-19)$
- C. a local maximum at $(2,19)$ and a local minimum at $(2,-13)$
- D. a local maximum at $(1,19)$ and a local minimum at $(5,-19)$
- E. a local maximum at $(1,19)$ and a local minimum at $(5,-13)$

Question 8

If $f(x) = 3\log_3(x+2) - 1$ cuts the X axis at b , then the value of b is

- A. -3
- B. -1
- C. $\sqrt[3]{3} - 2$
- D. $\sqrt[3]{\frac{1}{3}} - 2$
- E. $\sqrt[3]{\frac{5}{3}}$

Question 9

If $y = 5 - 3\sin(2x)$, then the maximum value of $\frac{dy}{dx}$ is

- A. 2
- B. 3
- C. 6
- D. 8
- E. 12

Question 10

If $f(x) = x^4 e^{-3x}$ then $f'(x)$ equals

- A. $x^3 e^{-3x} (4-3x)$
- B. $-12x^3 e^{-3x}$
- C. $4x^3 e^{-3x} - x^4 e^{-3x}$
- D. $-3x^4 e^{-3x}$
- E. $-3x^4 e^{-6x}$

Question 11

If $y = \frac{2x^2}{x^3 + 2}$ then $\frac{dy}{dx}$ equals 0 when

- A. $(x^3 + 2) = 0$
- B. $x^3 - 2x^2 + 2 = 0$
- C. $4x^3 + 8 - 2x^4 = 0$
- D. $4x^3 + 8 - 6x^4 = 0$
- E. $x(4 - x^3) = 0$

Question 12

If $V = (2y - 3)^5$ and $y = (2x - 3)^2$ then $\frac{dV}{dx}$ equals

- A. $40(2x - 3)^5$
- B. $10(2x - 3)^5$
- C. $40(2y - 3)^4(2x - 3)$
- D. $10(2y - 3)^4(2x - 3)$
- E. $8x$

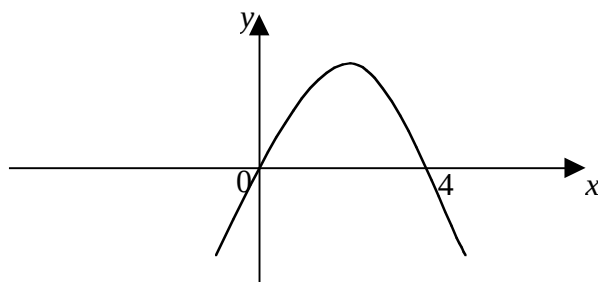
Question 13

The gradient of a curve $y = f(x)$ is given by $f'(x) = (3 - x)(5 - 2x)$.

The equation of this curve that passes through the point (6,66) is $f(x)$ equals

- A. $\frac{2}{3}x^3 - \frac{11}{2}x^2 + 15x$
- B. $\frac{2}{3}x^3 - \frac{11}{2}x^2 + 15x - 420$
- C. $\frac{2}{3}x^3 - \frac{11}{2}x^2 + 15x + 486$
- D. $\frac{2}{3}x^3 - \frac{11}{2}x^2 + 15x + 198$
- E. $\frac{2}{3}x^3 - \frac{11}{2}x^2 + 15x + 30$

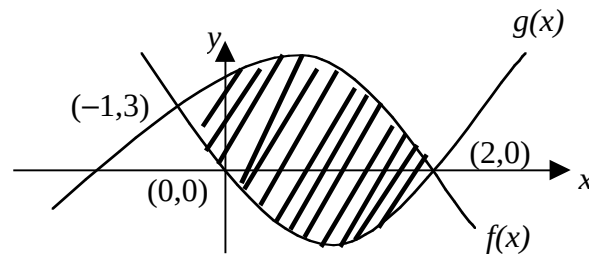
Question 14



The above graph has the equation $y = 4ax - ax^2$. The area between the curve and the X axis is

- A. $10\frac{2}{3}a$
- B. $11\frac{2}{3}a$
- C. $12a$
- D. $21\frac{1}{3}a$
- E. $42\frac{2}{3}a$

Question 15



The shaded area in the above graph is equal to

- A. $\int_{-1}^2 [g(x) - f(x)] dx$
- B. $\int_{-1}^0 [f(x) - g(x)] dx + \int_0^2 [g(x) - f(x)] dx$
- C. $\int_0^3 [f(x) - g(x)] dx$
- D. $\int_0^3 [g(x) - f(x)] dx$
- E. $\int_{-1}^2 [f(x) - g(x)] dx$

Question 16

An antiderivative of $\frac{2x^2 - 1}{x} + \frac{1}{x - 2}$ could be

- A. $x^2 + \log_e \left(\frac{x-2}{x} \right)$
- B. $x^2 + \log_e 2$
- C. $\frac{2x^2 + 1}{x^2} + \log_e (x - 2)$
- D. $x^2 - \log_e (x^2 - 2x)$
- E. $x^2 + \log_e (x^2 - 2x)$

Question 17

An approximation for the area enclosed by the graph $y = 3^x$ and the X axis, between $x = 0$ and $x = 4$, using interval widths of one unit and using the trapezoidal method is

- A. 78
- B. 80
- C. 156
- D. 120
- E. 240

Question 18

A straight line of the form $ax + y + b = 0$ is perpendicular to the line $2y = x - 6$ at the point $(4, -1)$.
The values of a and b are

- | | a | b |
|----|----------------|------|
| A. | $-\frac{1}{2}$ | -1 |
| B. | $\frac{1}{2}$ | 3 |
| C. | -2 | 7 |
| D. | -2 | -7 |
| E. | 2 | -7 |

Question 19

The side length of a cube is 10 cm. If the length of each side is increased by 0.2 cm., then the approximate increase in the cube's surface area is

- A. 2.4 cm^2
- B. 6 cm^2
- C. 12 cm^2
- D. 18 cm^2
- E. 24 cm^2

Question 20

If $x^2 - 2x + 3 = A(x^2 + 2) + (Bx + C)(x + 1)$

Then C equals

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

Question 21

Which one of the following statements is true about the graph of $y = 4(x - 3)^3 + 2$?

- A. The domain is R and the range is R^+
- B. A stationary point of inflexion occurs at $(-3, 2)$
- C. The graph of $y = x^3$ has been dilated by a factor of 4 parallel to the y axis
- D. The graph of $y = x^3$ has been dilated by a factor of $\frac{1}{4}$ parallel to the x axis
- E. The graph of $y = x^3$ has been translated 3 units to the left parallel to the x axis

Question 22

The graph of $y = \frac{5}{2x - 4} + 3$ has asymptotes with equations

- A. $x = 2, y = 3$
- B. $x = 4, y = 3$
- C. $x = -4, y = 3$
- D. $x = 4, y = -3$
- E. $x = -4, y = -3$

Question 23

	Girls	Boys
VCE language	23	17
No VCE language	14	18

The above table shows the number of girls and boys at a certain school who study a language at VCE. One of the language students is picked at random. The probability that this student is a boy is

- A. $\frac{5}{9}$
- B. $\frac{17}{18}$
- C. $\frac{17}{32}$
- D. $\frac{17}{35}$
- E. $\frac{17}{40}$

Question 24

Which one of the following represents a probability function?

- A. $P(x) = \frac{1}{4}(2x + 1)$ where $x = 0, 1$
- B. $P(x) = \frac{1}{30}(5x - 1)$ where $x = 0, 1, 2, 3$
- C. $P(x) = \frac{1}{30}(5x + 1)$ where $x = 0, 1, 2, 3$
- D. $P(x) = \frac{1}{10}x^2(4 - x)$ where $x = 0, 1, 2, 3, 4$
- E. $P(x) = \frac{1}{100}x^2(8 - x)$ where $x = 0, 1, 2$

Question 25

A box contains 8 blue balls and 10 green balls. A sample of 5 balls is drawn at random without replacement. The standard deviation of the number of blue balls in the sample is closest to

- A. 0.94
- B. 0.97
- C. 1.11
- D. 1.23
- E. 2.22

Question 26

A fair die is tossed ten times. The probability of getting at least 9 sixes is

- A. $\left(\frac{1}{6}\right)^{10} + \binom{10}{9}\left(\frac{1}{6}\right)^9\left(\frac{5}{6}\right)$
- B. $\binom{10}{9}\left(\frac{1}{6}\right)^9\left(\frac{5}{6}\right)$
- C. $\left(\frac{1}{6}\right)^{10} + \binom{10}{10}\left(\frac{1}{6}\right)^{10}\left(\frac{5}{6}\right)^0$
- D. $\frac{\binom{6}{1}\binom{5}{4}}{\binom{10}{9}}$
- E. $\left(\frac{1}{6}\right)^9 \times \frac{5}{6}$

Question 27

For a normal distribution with a mean of 90 and a standard deviation of 2.5, the probability that X lies within $\pm a$ of the mean is 0.82. The value of a is closest to

- A. 0.92
- B. 1.34
- C. 1.87
- D. 2.29
- E. 3.35

END OF PART I
MULTIPLE CHOICE QUESTION BOOK

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VICTORIAN CERTIFICATE OF EDUCATION
2004

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

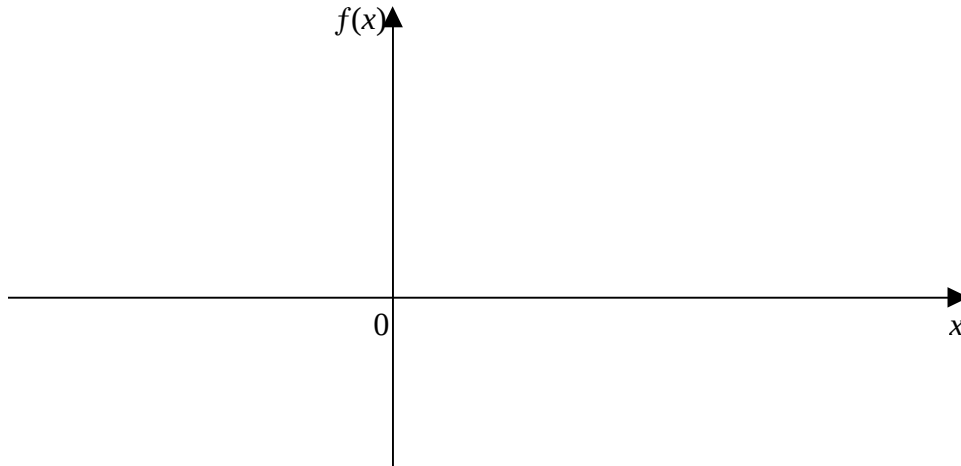
<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
6	6	23

Specific Instructions to students

Answer **all** questions in this part in the spaces provided.

Question 1

- a. On the axes below, sketch the graph of $f(x) = 2x^3 + 1$ $0 \leq x \leq 3$
Clearly label all important points.



- b. State the range of $f(x)$

-
- c. On the same set of axes, sketch $f^{-1}(x)$ showing all relevant points.

(1 + 1 + 1 = 3 marks)

Question 2

The function g is defined by $g(x) = 2x^2 - 12x + 31$

- a.** Express g in the form $g(x) = 2(x + a)^2 + b$ where a and b are integers.

- b.** Describe the transformations by which the graph of $f(x) = x^2$ is mapped to the graph of $y = g(x)$

(2 + 3 = 5 marks)

Question 3

- a.** For the curve $y = x^2 e^x$ find the coordinates of the points where $x = 0$ and $x = -2$. Give exact values.

- b.** Use calculus to show that the tangents to the graph $y = x^2 e^x$ at the points where $x = 0$ and $x = -2$ are horizontal lines.

(2 + 3 = 5 marks)

Find the exact solutions of the equation $2\sin(2\pi x)\cos(2\pi x) + \sqrt{3}\sin(2\pi x) = 0$ $0 \leq x \leq 2$

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface.

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If $2\log_a x + \log_a 5 = 1 + \log_a(8x - 3a)$ find, in terms of a , the possible values of x , where a is a positive constant.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface.

Question 6

- a. A batch of 20 thumb tacks contains 4 defectives. Jess takes 6 thumb tacks at random from the batch. What is the probability that her selection contains at least one defective? Give your answer to four decimal places.

Question 6 (continued)

- b. From a similar batch of 20 thumb tacks, Juan Li selects a thumb tack, inspects it, and then returns it to the batch before selecting another thumb tack. She does this four times. What is the probability that the second and fourth thumb tacks she withdraws are the only two defective thumb tacks she selects? Give your answer to four decimal places.

- c. Abdul withdraws 4 thumb tacks with replacement from a similar batch of 20 thumb tacks. He rejects the batch if he withdraws at least one defective thumb tack. What is the probability he accepts the batch?

(2 + 1+1 = 4 marks)

**End of 2004 Mathematical Methods Trial Examination 1
Question and Answer Book**

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