## SECTION A

**Specific Instructions for Section A**

*Section A* consists of 33 questions.
Answer **all** questions in this section on the multiple-choice answer sheet provided.
A correct answer scores 1, an incorrect answer scores 0.
No credit will be given for a question if two or more letters are marked for that question.
Marks will not be deducted for incorrect answers.
You should attempt every question.

**Question 1**

A set of mathematics test scores has a normal probability distribution with mean $\mu = 43$, and standard deviation $\sigma = 6$. Which of the following intervals contains about 95% of the test scores?

**A.** $37 \le x \le 49$ **B.** $31 \le x \le 55$ **C.** $25 \le x \le 61$ **D.** $40 \le x \le 46$ **E.** $34 \le x \le 52$

**Question 2**

The derivative of $f(x) = \log_e x - \log_e(x^2 - x)$ is

**A.** $\frac{-1}{(x-1)^2}$ **B.** $\frac{-x-2}{x^2-x}$ **C.** $\frac{1}{(x-1)^2}$ **D.** $\frac{-1}{x-1}$ **E.** $\frac{1}{(x-1)^3}$

**Question 3**

The implied maximal domain for $y = \frac{2}{\sqrt{-6+x}}$ is

**A.** $(6, \infty)$ **B.** $[-\infty, 6)$ **C.** $R \setminus \{6\}$ **D.** $(-6, \infty)$ **E.** $[6, \infty)$

**Question 4**

A ball has a radius of 7 cm. The increase in the surface area $A$ cm$^2$ when the radius expands by $h$ cm, where $h$ is small, is

**A.** $14\pi h$ **B.** $\pi(h+7)^2$ **C.** $56\pi h$ **D.** $4\pi(7+h)^2$ **E.** $8\pi(h+7)$

**Question 5**

The graph $y = 3 + \frac{2}{2x-1}$ will have asymptotes at

**A.** $x = 1$, $y = 3$ **B.** $x = -1/2$, $y = 3$ **C.** $x = -1$, $y = 0$ **D.** $x = 1$, $y = -3$ **E.** $x = 1/2$, $y = 3$

**Question 6**

If $y = (5x^3 - 3x)^5$ then $\frac{dy}{dx}$ is

**A.** $5(5x^3 - 3x)^4$
**B.** $5(15x^2 - 3)^4$
**C.** $(15x^2 - 15)(5x^3 - 3x)^4$
**D.** $(75x^2 - 15)(5x^3 - 3x)^4$
**E.** $5(15x^3 - 3x)^4$

**Question 7**

$x^4 - 3x^3 + 9x^2 - 27x + 81$ may be expressed as

**A.** $\sum_{i=0}^{4} x^{4-i}(-3^i)$ **B.** $\sum_{i=0}^{4} (-3x)^i$ **C.** $\sum_{i=1}^{5} x^{5-i}3^{i-1}$

**D.** $\sum_{i=0}^{4} (-3x)^{4-i}$ **E.** $\sum_{i=0}^{4} (-3)^i x^{4-i}$

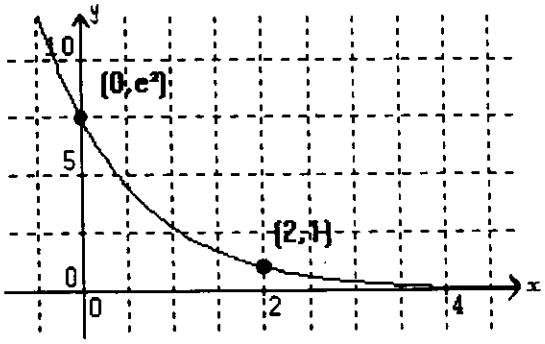
**Question 8**

The graph of $y = b^2x^2 - x^3$

**A.** touches the $x$-axis at 0 and $b^2$.
**B.** touches the $x$-axis at $0$ and cuts across the $x$-axis at $b$.
**C.** cuts across the $x$-axis at $-b$, 0 and $b$.
**D.** touches the $x$-axis at 0 and cuts across the $x$-axis at $b^2$.
**E.** touches the $x$-axis at 0 and cuts across the $x$-axis at $-b$ and $b$.

**Question 9**

The graph at right represents the function defined by $y = e^{a(x-b)}$, where




**A.** $y = e^{(x-2)}$
**B.** $y = e^{(x+2)}$
**C.** $y = e^{2(x-1)}$
**D.** $y = e^{-(x+2)}$
**E.** $y = e^{-(x-2)}$

**Question 10**

If $f'(x) = 3x^2 - \frac{2}{x+2}$ and $f(-1) = -1$, then $f(x)$ is

**A.** $x^3 - 2\log_e(x+2) - 1$ **B.** $x^3$ **C.** $x^3 - 2\log_e(x+2)$ **D.** $x^3 - 2(x+2)^{-1} - 1$ **E.** $6x$

**Question 11**

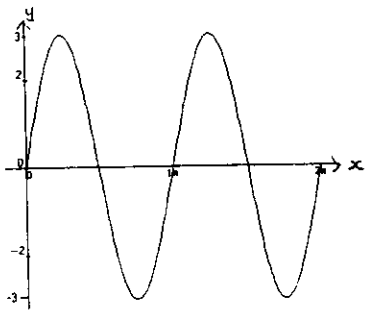
Which one of the following is ***not*** a one-to-one function?

**A.** f: $[0, \infty) \to R, f(x) = x^2$
**B.** f: $[0, \infty) \to R, f(x) = 8$
**C.** f: $[0, \infty) \to R, f(x) = 5 - x^2$
**D.** f: $[0, \infty) \to R, f(x) = 3x + 9$
**E.** f: $[0, \infty) \to R, f(x) = \sqrt{x}$

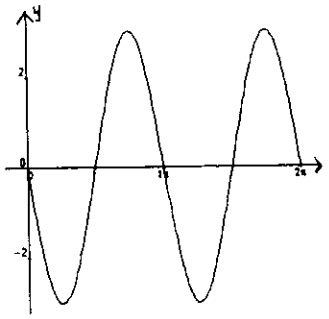
**Question 12**

Let $f : [0, 2\pi] \to R$ where $f(x) = -3\sin(2x + \pi)$. Which one of the following graphs best represents the graph of $f(x)$ ?

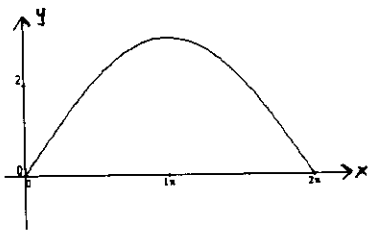
**A.**



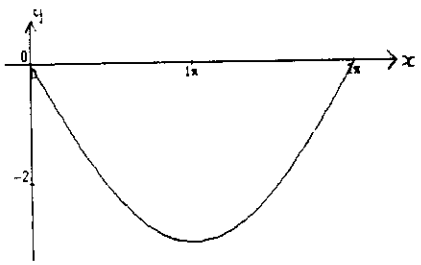
**B.**



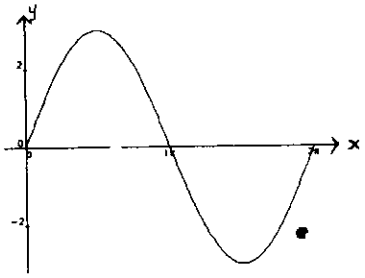
**C.**



**D.**



**E.**



**Question 13**

The function $f: [0, \pi] \rightarrow R$, $f(x) = \cos x + 2$ has an **inverse function** whose rule is $f^{-1}(x) = \text{Cos}^{-1}(x - 2)$. The **domain** of the inverse function $f^{-1}$ is

**A.** $[-1,1]$ **B.** $[0, \pi]$ **C.** $[0, 2]$ **D.** $[1, 3]$ **E.** $[\pi, 3\pi]$

**Question 14**

The solution set of the equation $e^{2x} - 6e^{x} = -5$ is

**A.** $\{ 0 \}$ **B.** $\{ 0, \log_e 6 \}$ **C.** $\{ 1, 5 \}$ **D.** $\{ 2, -3 \}$ **E.** $\{ 0, \log_e 5 \}$

**Question 15**

If $f(x) = 2x^2 + 1$ then the value of $\dfrac{f(2+h) - f(2)}{h}$ is

**A.** $4x$ **B.** $\dfrac{h^2 + 4h - 4}{h}$ **C.** $8$ **D** $8+2h$ **E.** $\dfrac{8 + 2h^2}{h}$

**Question 16**

The **period** and **amplitude** of the trigonometric function whose graph is shown below are respectively

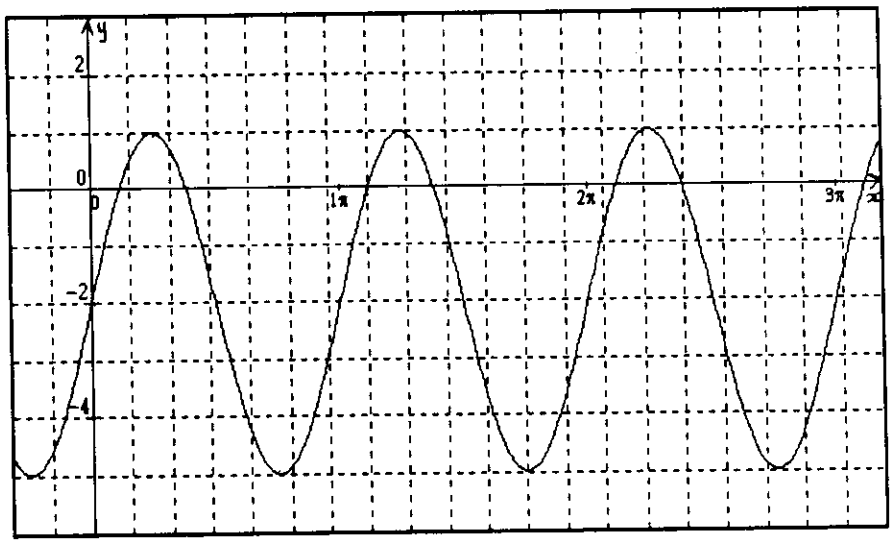
**A.** $\pi/2$ and 4

**B** $\pi$ and 3

**C.** $\pi/2$ and -2

**D.** $\pi$ and -3

**E.** ~~$\pi$ and 6~~



# No. 24



**Question 17**

$\int e + (3+4x)^2\,dx$ is equal to

**A.** $ex + \frac{(3+4x)^3}{12} + c$ **B.** $\frac{(3+4x)^3}{3} + c$ **C.** $e^x + \frac{(3+4x)^3}{12} + c$

**D.** $ex + \frac{(3+4x)^3}{3} + c$ **E.** $8(3+4x) + c$

**Question 18**

If $y = e^{2\cos\frac{x}{2}}$ then $\frac{dy}{dx}$ equals

**A.** $\cos\frac{x}{2}.e^{2\sin\frac{x}{2}}$ **B.** $2\cos\frac{x}{2}.e^{2\cos\frac{x}{2}}$ **C.** $e^{\sin\frac{x}{2}}$ **D.** $-\sin\frac{x}{2}.e^{2\cos\frac{x}{2}}$ **E.** $\sin\frac{x}{2}.e^{2\cos\frac{x}{2}}$

**Question 19**

The area between the curve with equation $y=3\sin 2x$ and the x-axis bound between x = 0 and $x = \pi$ is equal to

**A.** 0 units$^2$ **B.** $\frac{27}{4}$ units$^2$ **C** 6 units$^2$ **D.** 1 units$^2$ **E.** 3 units$^2$

**Question 20**

The range of the function $f(x) = 1 + 2e^{-x}$, $x \in R$ is

**A.** $[1/2, \infty)$ **B.** $(2, \infty)$ **C.** $R \setminus \{1\}$ **D.** $(1, \infty)$ **E.** $(-\infty, \infty)$

**Question 21**

The shaded area shown is equal to

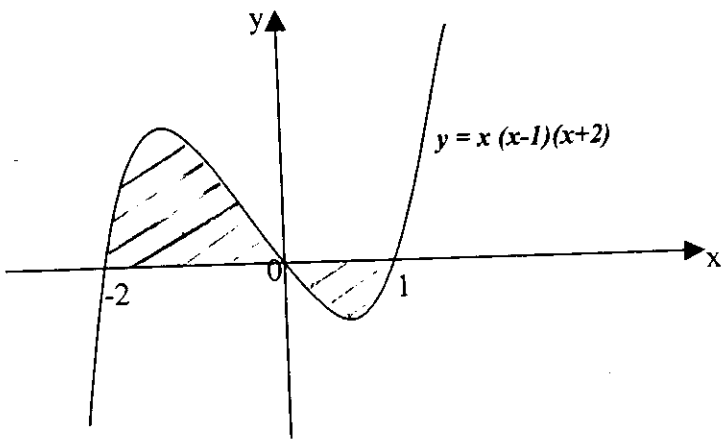
**A.** 2.25 units$^2$

**B.** 0.50 units$^2$

**C.** 0 units$^2$

**D.** 3.08 units$^2$

**E.** 5.33 units$^2$



**Question 22**

The equation of the normal to the curve with equation $y = \frac{5 - x^2}{3x}$ at the point $\left(1, \frac{4}{3}\right)$ is equal to

**A.** $y = 2x + \frac{5}{6}$ **B.** $y - \frac{5}{6} = \frac{1}{2}x$ **C.** $y = 2x - \frac{10}{3}$ **D.** $y + \frac{5}{6} = \frac{-1}{2}x$ **E.** $y + 2x = \frac{10}{3}$

**Question 23**

The solutions of the equation $2\sin x - 1 = 0$ for $\frac{\pi}{2} \le x \le 2\pi$ are

**A.** $\frac{5\pi}{6}$ and $\frac{13\pi}{6}$ **B.** $\frac{\pi}{6}$ and $\frac{5\pi}{6}$ **C.** $\frac{\pi}{6}$ **D.** $\frac{5\pi}{6}$ and $\frac{7\pi}{6}$ **E.** $\frac{5\pi}{6}$

**Question 24**

If $y = \frac{5x^2}{e^{2x}}$ the maximum value on the domain $[0, +\infty)$ occurs at approximately

**A.** 1 **B.** -1 **C.** 0.67 **D.** 0 **E.** undefined

**Question 25**

A runner's position during a marathon, $P$ metres after $t$ seconds is given by $P = 0.3\,t^3 + 0.2\,t^2$. The average rate of change of his position between the times $t = 1$ and $t = 3$ is

**A.** 8 m/s **B** 4.7 m/s **C.** 3.15 m/s **D.** 4 m/s **E.** -8 m/s

**Question 26**

Mokia mobile phones generally receive calls within an 8km radius of a transmitting station. Mokia has determined that the coverage range is normally distributed with a mean of 7.7 km and a variance of
0.25 km. The probability that mobile phones will receive calls from a distance greater than 6.6 km is equal to

**A.** 0.0139 **B.** 0.9861 **C.** 0.5088 **D.** 0.0136 **E.** 0.9864

**Question 27**

A recent study found that Z, the number of houses sold per week by a real estate agent, has a probability distribution given by

| Z | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Pr (Z=z) | 0.05 | 0.25 | k | 0.3 | m | 0.03 |

If the mean number of houses sold per week is 2.38 the values of k and m respectively are

**A.** 0.10, 0.27 **B.** 0.15, 0.22 **C.** 0.20, 0.17 **D.** 0.22, 0.15 **E.** 0.18, 0.19

**Question 28**

A chocolate bar manufacturer places a coupon in every fifth bar entitling the consumer to a free chocolate bar. If a student purchases 7 chocolate bars throughout the school week, the probability of finding 3 coupons in a given week is

**A.** ${}^{7}C_{3}(0.2)^{4}(0.8)^{3}$ **B.** ${}^{7}C_{4}(0.2)^{4}(0.8)^{3}$ **C.** $\binom{5}{3}(0.2)^{3}(0.8)^{2}$

**D.** $(0.2)^{7}$ **E.** ${}^{7}C_{3}(0.2)^{3}(0.8)^{4}$

**Question 29**

A soils engineer undertakes a drilling investigation at a building site to reveal the depth of basalt bedrock from ground level. The probability that he will be successful in hitting basalt rock after drilling 3m from ground level is 0.35 . What is the probability that the fourth borehole is the first to hit basalt rock ?

**A.** 0.350 **B.** 0.985 **C.** 0.821 **D.** 0.015 **E.** 0.0961

**Question 30**

If $X$ is a random variable such that E $(X) = 5$ then E $(2X - 4)$ has a value of

**A.** 6 **B.** 25 **C.** 20 **D.** -6 **E.** 46

**Question 31**

*"Polyplex Construction's"* project schedules indicate that on average the probability of *not* completing a project on time is 0.15. Given that the company undertakes 15 projects per year, the probability that exactly 6 projects are completed on time is

**A.** ${}^{15}C_{6}(0.85)^{9}(0.15)^{6}$ **B.** $(0.85)^{6}$ **C.** $\binom{15}{6}(0.85)^{6}(0.15)^{9}$

**D.** $\binom{15}{6}(0.85)^{6}(0.15)^{15}$ **E.** $6(0.85)$

**Question 32**

A chocolate box contains 8 caramel centres and 4 peppermint creams. Three chocolates are chosen at random from the box without replacement. The probability that at least one chocolate of each type was selected is

**A.** $\frac{\binom{8}{1}\binom{4}{2}+\binom{8}{2}\binom{4}{1}}{\binom{12}{3}}$ **B.** $\frac{\binom{8}{1}\binom{4}{2}\times\binom{8}{2}\binom{4}{1}}{\binom{12}{3}}$ **C.** $\frac{\binom{8}{1}\binom{4}{2}+\binom{8}{2}\binom{4}{1}}{12}$

**D.** $\frac{\binom{8}{1}\binom{4}{2}\times\binom{8}{2}\binom{4}{1}}{3}$ **E.** $\frac{\binom{8}{1}\binom{4}{2}\times\binom{8}{2}\binom{4}{1}}{3!}$

**Question 33**

Seventy four percent of graduates seeking employment through *seeker.com* gain employment. In a random sample of 15 graduates the probability that one or more graduates will successfully gain employment is

**A.** $1-{}^{15}C_0(0.26)^{15}(0.74)^0$ **B.** $1-{}^{15}C_1(0.26)\ (0.74)^{14}$ **C.** $(0.74)^{14}$

**D.** ${}^{15}C_{14}(0.26)\ (0.74)^{14}$ **E.** $1-(0.74)^{15}$

**END OF SECTION A**

**No. 24**



## SECTION B

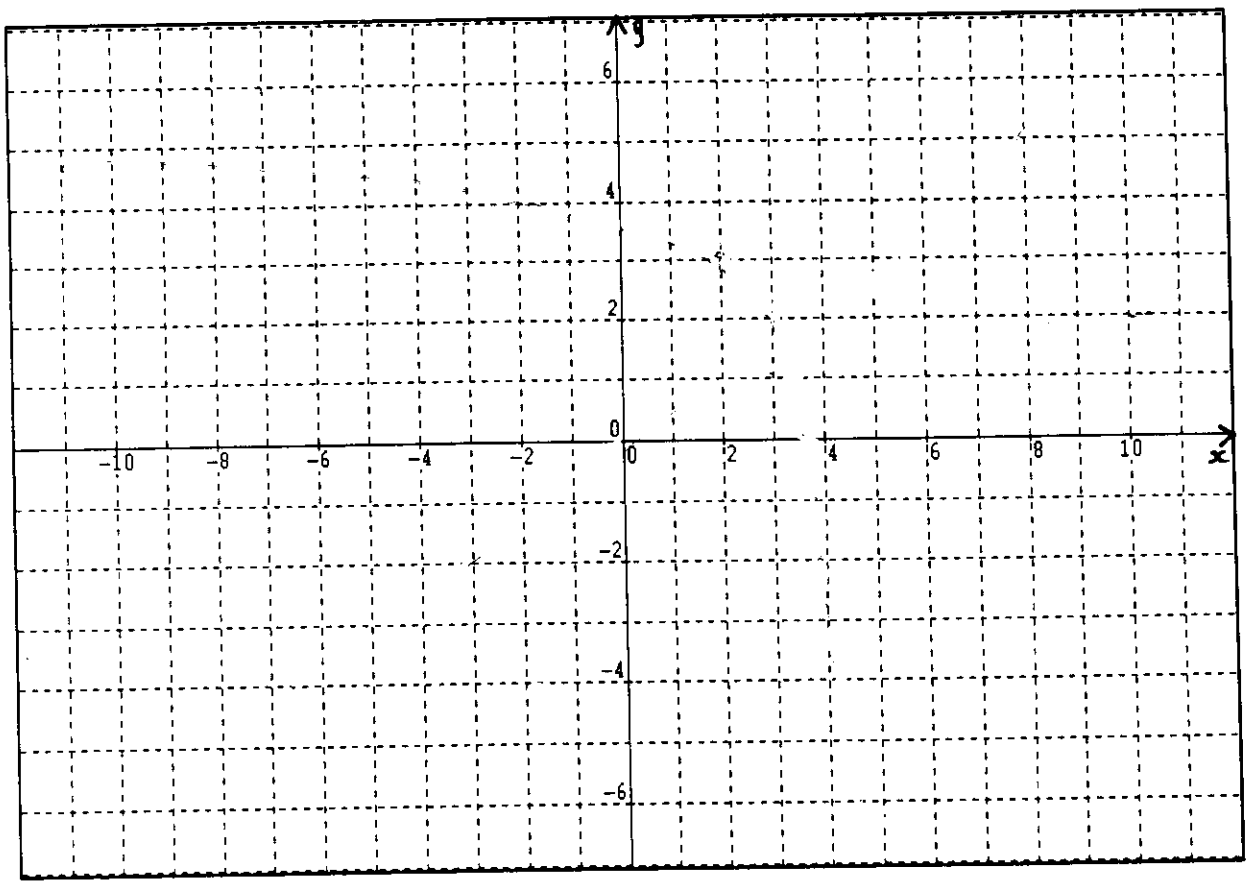
**Specific Instructions for Section B**

Section B consists of 6 questions. There are a total of 17 marks available.
Answer all six questions in the spaces provided in this question and answer booklet.
You need not give numerical answers as decimals unless instructed to do so.
Alternative forms may involve, for example, $\pi$, $e$, surds or fractions.
Full marks may not be given for answers which do not show appropriate working or do not clearly state answers.

### Question 1

The function $f$ is defined as $f:(-\infty,3] \rightarrow R$ where $f(x) = 2 + \sqrt{3-x}$

a) Sketch the graph of the **function $f$** and the **inverse function $f^{-1}$** on the same set of Cartesian axes below.




(2 marks)

b) State the **domain** and the **range** of the function $f$.

Domain of $f(x)$ :

Range of $f(x)$ :

(2 marks)

c) State the **domain** and **rule** of the **inverse function** $f^{-1}$.

Domain of $f^{-1}(x)$ :

Rule of $f^{-1}(x)$ :

(2 marks)

**Total 6marks**

**Question 2**

Find $\{x : \sqrt{3} + 2\cos 2x = 0, -\pi \leq x \leq \pi\}$

**Total 3 marks**

**Question 3**

Find the derivative of $\log_e(x^2-2)$. Hence find $\int \frac{6x}{x^2-2}.dx$

**Total 2 marks**

**Question 4**

The annual profit ***$P*** for the *Tarjay Fashion* company is related to the number of employees ***n***, by $P(n) = -n(2n^2 - 900)$.

Find a) the number of employees for maximum profit

(1 mark)

b) the maximum profit

(1 mark)

**Total 2 marks**

**Question 5**

Poppy has monitored the arrival time of her tram at the tramstop in the mornings for the past few months. Her records have revealed that the tram arrival time is normally distributed with a mean value of 7.15am and a standard deviation of 5 minutes. What is the probability that her tram will arrive at least 10 minutes earlier?

**Total 2 marks**

**Question 6**

If 60% of Australian people are in favour of the GST, find the probability that out of 5 people chosen at random at least one will be in favour of the GST.

**Total 2 marks**

**END OF SECTION B**
**END OF BOOKLET**

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