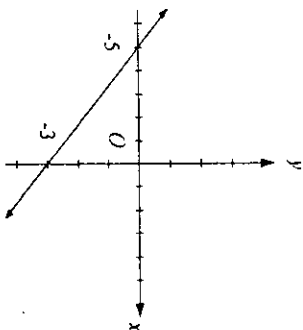


Part I (Multiple-choice Questions)

Question 1

The equation of the line shown here is

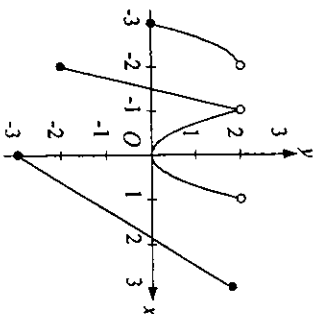
- A. $y = 3x - 5$
- B. $-5x - 3y = 15$
- C. $y = \frac{3}{5}x - 3$
- D. $5y + 3x = -15$
- E. $y = -5x - 3$



Question 2

The domain of the relation whose graph is shown here is

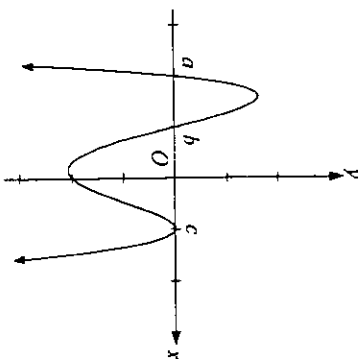
- A. $[-3, -1) \cup (-1, 3]$
- B. $(-3, 3)$
- C. $[-3, 1] + [0, 3]$
- D. $[-3, 1]$
- E. $[-3, 3]$



Question 3

A possible equation for the graph shown would be

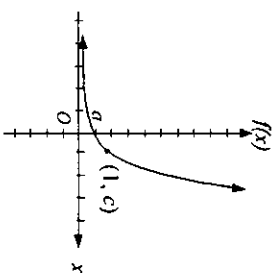
- A. $f(x) = (x - a)(x - b)(x - c)$
- B. $f(x) = -(x - a)(x - b)(x + c)^2$
- C. $f(x) = (x - a)(x - b)(x + c)^2$
- D. $f(x) = (x - a)(x - b)(x - c)^2$
- E. $f(x) = -(x - a)(x - b)(x - c)^2$



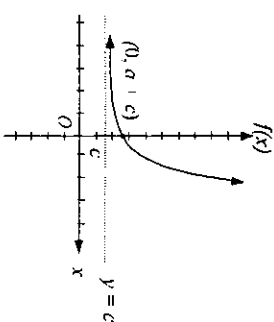
Question 4

Which one of the following graphs would fit the equation $f(x) = ae^{bx} + c$ if $a > 0$, $b = 0$ and $c > 0$?

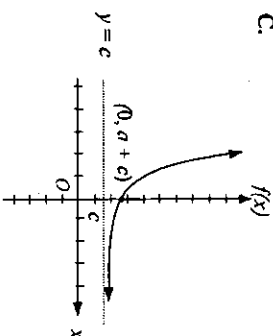
A.



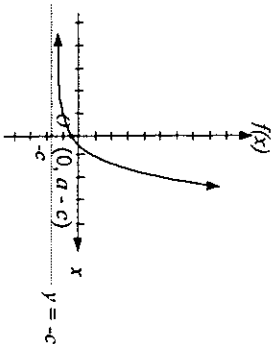
B.



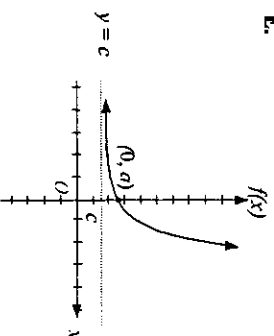
C.



D.



E.



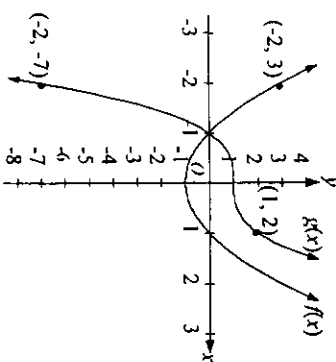
Question 5

The parabola with the equation $y = x^2$ is translated so that its image has a vertex (a, b) where $a < 0$ and $b > 0$. The equation of the image is

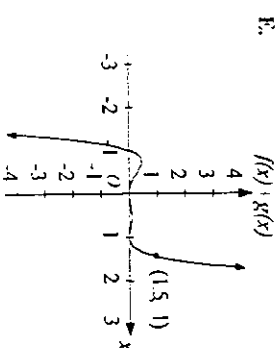
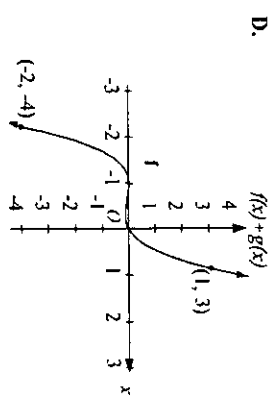
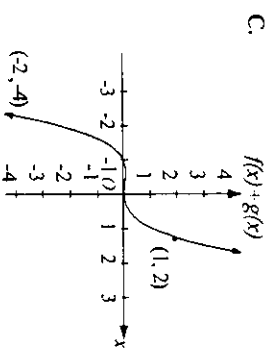
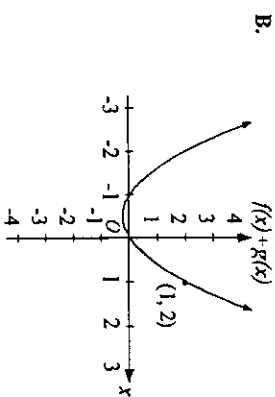
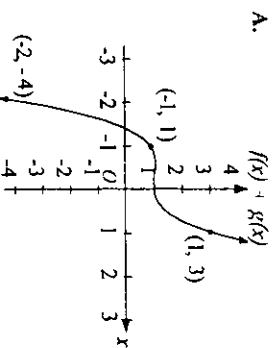
- A. $y = (x - a)^2 + b$
- B. $y = (x + a)^2 - b$
- C. $y = (x + a)^2 + b$
- D. $y = (x - a)^2 - b$
- E. $y = -ax^2 + b$

Question 6

The axes shown on the right display two separate graphs $f(x)$ and $g(x)$



Which of the following graphs would best display the combination of the graphs, $f(x) + g(x)$?



Question 7

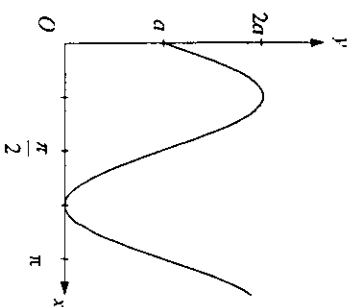
In comparison with the graph of $y = \sin(x)$, the graph of $y = 2\sin(2x + \frac{\pi}{2})$ has

- A. double the amplitude, half the period and is shifted $\frac{\pi}{2}$ units to the left
- B. half the amplitude, half the period and is shifted $\frac{\pi}{2}$ units to the right
- C. double the amplitude, half the period and is shifted $\frac{\pi}{4}$ units to the right
- D. double the amplitude, half the period and is shifted $\frac{\pi}{4}$ units to the left
- E. double the amplitude, half the period and is shifted $\frac{\pi}{2}$ units up

Question 8

A possible equation of the graph shown is

- A. $y = 2a\sin(x)$
- B. $y = a\sin(2x+1)$
- C. $y = a + \sin(x - \pi)$
- D. $y = -a + a\sin(2x)$
- E. $y = a + a\sin(2x)$



Question 9

The solutions between 0 and π for which $\cos(3x) + \sqrt{3}\sin(3x) = 0$ are

- A. $\frac{5\pi}{18}, \frac{11\pi}{12}$
- B. $\frac{5\pi}{18}, \frac{11\pi}{18}, \frac{17\pi}{18}$
- C. $\frac{5\pi}{18}, \frac{23\pi}{18}, \frac{35\pi}{18}$
- D. $\frac{5\pi}{9}, \frac{11\pi}{9}, \frac{17\pi}{9}$
- E. 0, 3, 5, 7

Question 10

The equation $m\sin(x) = n\cos(4x)$, where $n > 0$ and $m > 0$, has how many solutions in the interval $[0, \pi]$?

- A. 0
- B. 1
- C. 4
- D. 2
- E. 3

Question 11

The equation of the normal of $f(x) = e^x$ at the point $(1, e)$ is

- A. $y = \frac{-x}{e} + \frac{1}{e} + e$
- B. $y = -e^x + 2e$
- C. $y = e^x$
- D. $y = e^x - e^e + e$
- E. $y = \frac{-x}{e} + 2$

Question 12

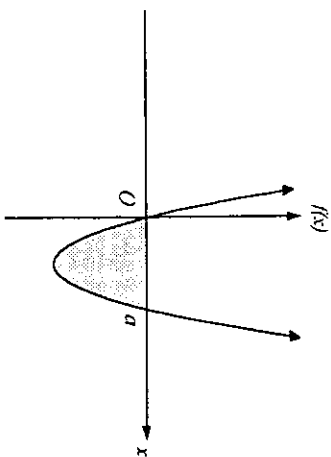
If $f(x) = 4e^{3x}\sin(2x)$ then $f'(x)$ equals

- A. $4e^{3x}(3\sin(2x) + 2\cos(2x))$
- B. $\frac{2}{3}e^{3x}(2\sin(2x) + 3\cos(2x))$
- C. $2e^{3x}(6\sin(2x) + \cos(2x))$
- D. $\frac{3}{2}e^{3x}(2\sin(2x) + 3\cos(2x))$
- E. $4e^{3x}(3\sin(2x) + 2\cos(2x))$

Question 13

The area of the shaded region of the graph is given by

- A. $\int_a^b -f(x)dx$
- B. $\int_0^a f(x)dx$
- C. $\int_0^a x - f(x)dx$
- D. $\int_0^a f(x) - xdx$
- E. $\int_0^a -f(x)dx$



Question 14

The derivative of $\frac{3x^2 - x}{x}$ is equal to

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

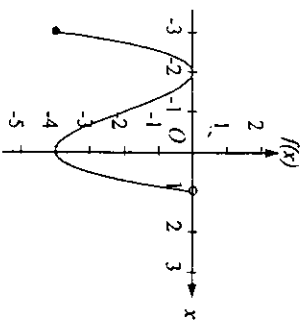
Question 15

An antiderivative of $\frac{1}{(3x+2)^2}$ is

- A. $\frac{-3}{(3x+2)^2}$
- B. $\frac{-1}{12(3x+2)^2}$
- C. $5 \log_6(3x+2)$
- D. $\frac{6}{(3x+2)^6}$
- E. $\frac{1}{6(3x+2)^4}$

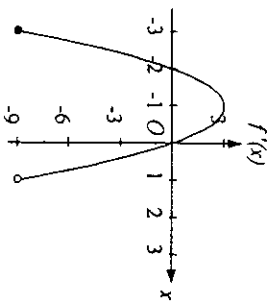
Question 16

The graph of the function $f: [-3, 1] \rightarrow \mathbb{R}$ is shown below

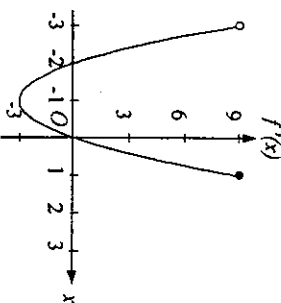


Which of the following is most likely to be the graph of the derived function f' ?

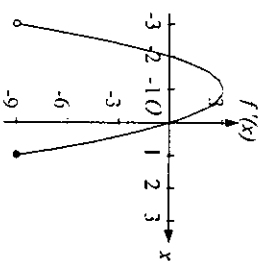
A.



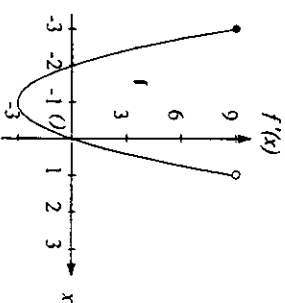
B.



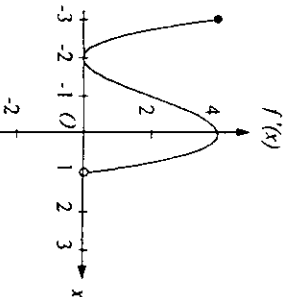
C.



D.



E.



Question 17

If $y = \frac{\log_2(2x)}{2x}$ then $\frac{dy}{dx}$ is

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

B. $\frac{-x^3}{2}$

C. $\frac{1 - 2\log_2(2x)}{2}$

D. $\frac{4x^2}{1 - \log_2(2x)}$

E. $\frac{2[1 - \log_2(2x)]}{x^2}$

Question 18

The coefficient of x^{10} in the expansion of $(3 - 2x)^{12}$ is

A. $-^{12}C_2(2)^{10}(9)$

B. $^{12}C_3(-2)^{10}(9)$

C. $^{12}C_3(-2)^{12}(9)^{10}$

D. $^{12}C_{10}(-2)^{10}(9)^2$

E. $-^{12}C_{10}(2)^{10}(3)^2$

Question 19

Which of the following is a solution of the equation, $3e^{2x} = 6?$

A. $2\log_2 2$

B. $2\log_2 3$

C. 0

D. $\frac{1}{2} \log_2 2$

E. $\frac{1}{2} \log_2 3$

Question 20

Let $h: [a, 2] \rightarrow \mathbb{R}$ where $h(x) = 2x - 2x^2$. If a is the smallest real value such that h has an inverse function h^{-1} , then a equals

- A. -1
- B. 0
- C. 1
- D. -2
- E. $\frac{1}{2}$

Question 21

If $f: \mathbb{R} \rightarrow \mathbb{R}$ where $f(x) = e^{2x-1}$, then $f^{-1}(x)$ equals

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

Question 22

If $2 + \log_{10}(3x) = \log_{10}(y)$, then

- A. $y = 100 + 3x$
- B. $y = \frac{3x}{100}$
- C. $y = 600x$
- D. $y = 300x$
- E. $y = \frac{100}{3x}$

Question 23

If $P(x) = x^3 + ax^2 - 6x + 8$ has a remainder of 24 when divided by $(x + 2)$, then the value of a is

- A. 3
- B. 12
- C. 2
- D. 7
- E. 9

Question 24

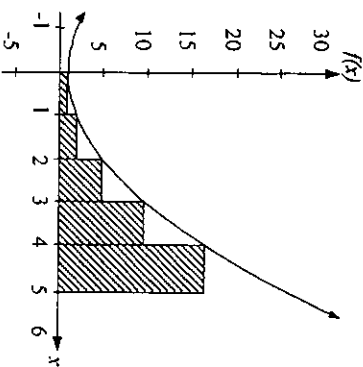
The derivative of xe^{2x} is $(2x + 1)e^{2x}$. Hence $\int xe^{2x} dx$ is equal to

- A. $\int (2x + 1)e^{2x} dx$
- B. $\int (2x - 1)e^{2x} dx$
- C. $2xe^{2x} + \int e^{2x} dx$
- D. $(2x + 1)e^{2x} + c$
- E. $\frac{e^{2x}}{2} (x - \frac{1}{2}) + c$

Question 25

The area under the graph $f(x) = x^2 + 1$ between $x = 0$ and $x = 5$ can be approximated by rectangular strips as shown in the diagram. The area of this approximation is

- A. 30 square units
- B. 35 square units
- C. 36 square units
- D. 40 square units
- E. $46\frac{2}{3}$ square units



The following information refers to questions 26 and 27

Fearful that she is not getting value for money, Maria decides to count the number of choc-chips in each of the 50 choc-chip cookies she bought recently. Her results are as follows

Number of choc-chips	0	1	2	3	4	5	6
Number of cookies with this number of choc-chips	1	2	5	6	15	13	8

Question 26
What proportion of cookies had less than 5 choc chips?

- A. $\frac{8}{50}$
- B. $\frac{13}{50}$
- C. $\frac{29}{50}$
- D. $\frac{42}{50}$
- E. $\frac{28}{50}$

Question 27
If Maria chose a cookie at random, what is the expected number of choc-chips in a cookie?

- A. 4.08
- B. 203
- C. 4.06
- D. 3
- E. 7.14

Question 28
For a particular binomial distribution with n independent trials, each with a probability of success p , the mean and standard deviation are 10 and $\sqrt{6}$ respectively. Which of the following gives the correct values for n , p and the variance of this distribution?

- A. $n = 16$, $p = 0.6$, variance = 10
- B. $n = 16$, $p = 0.6$, variance = 6
- C. $n = 25$, $p = 0.6$, variance = 36
- D. $n = 25$, $p = 0.4$, variance = $\sqrt{6}$
- E. $n = 25$, $p = 0.4$, variance = 6

Question 29
Which of the following is **not** an example of a discrete random variable?

- A. The numbers of students sitting Mathematical Methods CATs over various years
- B. The numbers of beans in a particular brand of bean bag
- C. The daily numbers of men seen wearing blue jeans in the Bourke Street Mall
- D. The numbers of girls born at the Royal Children's Hospital
- E. The lengths of tapes in 30-minute audiocassettes

Question 30
Whenever Arts shoots for goal in a game of soccer, the probability that he will score a goal is 0.3. In one game, he shoots for goal 10 times. What is the probability that he will score more than 1 goal?

- A. $(0.3)^{10}$
- B. $1 - [{}^{10}C_1(0.3)(0.7)^9]$
- C. $1 - [(0.7)^{10} + 10(0.3)(0.7)^9]$
- D. $(0.7)^{10} + {}^{10}C_1(0.3)(0.7)^9$
- E. ${}^{10}C_1(0.3)(0.7)^9$

Question 31
Brakins, a statistical surveying company, has been hired to a 95% confidence interval for the proportion of a population who like vegemite. What is minimum number of people that they need to interview to ensure that the margin of error of their result is no more than 5%?

- A. 144
- B. 256
- C. 384
- D. 400
- E. 475

not on course

The following information refers to questions 32 and 33

The maximum temperature, T° , of a November day in Melbourne has been found to be normally distributed with a mean of 24°C and a standard deviation of 2°C .

Question 32

What would the standard normal expression be for the probability of the maximum temperature being 27°C or more?

- A. $\Pr(Z > 1)$
- B. $\Pr(Z < 1)$
- C. $1 - \Pr(Z < \frac{3}{2})$
- D. $1 - \Pr(Z > \frac{3}{2})$
- E. $\Pr(-\frac{3}{2} < Z < \frac{3}{2})$

Question 33

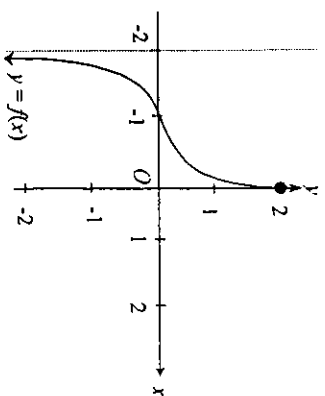
The values of c_1 and c_2 such that $\Pr(c_1 < Y < c_2) = 0.95$ would be closest to

- A. $c_1 = 20$ and $c_2 = 26$
- B. $c_1 = 21$ and $c_2 = 28$
- C. $c_1 = 18$ and $c_2 = 30$
- D. $c_1 = 20$ and $c_2 = 28$
- E. $c_1 = 21$ and $c_2 = 26$

Part II (Short Answer Questions)

Question 1

The graph of a function, f , is shown below.



- a. On the same set of axes, sketch the graph of f^{-1} . 2 marks
- b. What is the range of f^{-1} ?

1 mark

Question 2

Hassan's intellectual biorhythm is modelled by the function

$$P = 2 + \sin \frac{2\pi}{28} t$$

where t is the number of days after today and P is Hassan's biorhythm level (no units are necessary).

- a. What will Hassan's biorhythm level be in 7 days' time?

1 mark

A biorhythm level of 1 indicates that Hassan is at his lowest intellectual potential

- b. How many days will it take for Hassan to reach a biorhythm level of 1?

2 marks

Question 3

For the equation $f(x) = \sin(2x)$ $0 \leq x \leq \pi$, find the exact coordinates of the first point on the curve where $f'(x) = 1$

3 marks

Question 4

At a certain company the total cost, in dollars, of manufacturing x calculators is given by

$$C(x) = 0.3x^2 + 20x + 200, \text{ where } 0 \leq x \leq 100.$$

- a. Calculate the cost of producing 50 calculators.

1 mark

- b. What is the maximum total cost of manufacturing calculators?

2 marks

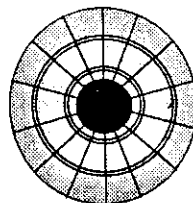
Question 5

If a is the coefficient of x^4 and b is the coefficient of x^2 in the expansion of $(2x - 1)^4$, find the ratio $\frac{a}{b}$.

3 marks

Question 6

Asrid is a darts player attempting to hit the dark bulls-eye section of the circular board shown in the diagram. She is allowed three throws, each of which hits the board at a random point.



The area of the bulls-eye is 136.5 cm^2
 The area of the whole dart board is 910.0 cm^2

- a. What is the probability that she scores at least one bulls-eye? Give your answer correct to two decimal places.

1 mark

- b. What is the probability that she scores exactly one bulls-eye? Give your answer correct to two decimal places.

1 mark

Total 17 marks