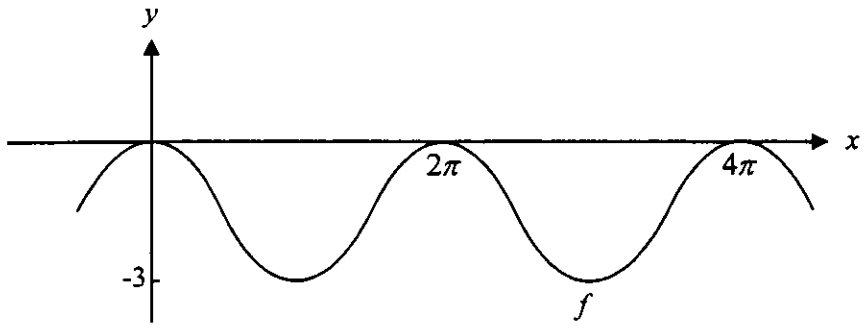
PART I

Question 1

The graph of the function f is shown below.



The amplitude of this function is

A. -3

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

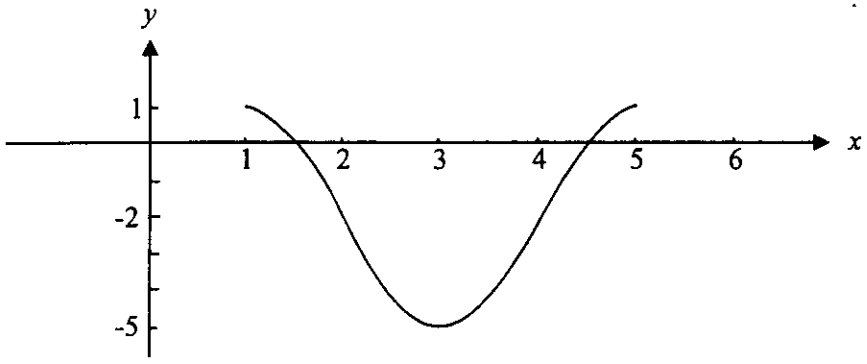
C. 0

D. $\frac{3}{2}$

E. 3

Question 2

One cycle of the graph of a circular function is shown on the diagram below.



The equation of this function could be

A. $y = 3\cos\frac{\pi}{2}(x-1)-2$

B. $y = 3\cos\frac{\pi}{2}(x+1)-2$

C. $y = 3\cos 2\pi(x-1)-2$

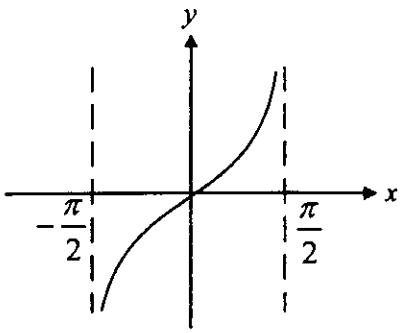
D. $y = 6\cos\frac{\pi}{2}(x+1)-2$

E. $y = 6\cos 2\pi(x+1)-2$

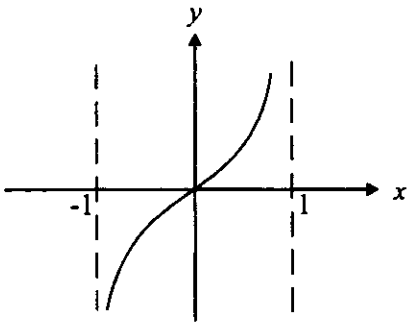
Question 3

The graph of $y = \tan(ax)$ where a is a constant could **not** be

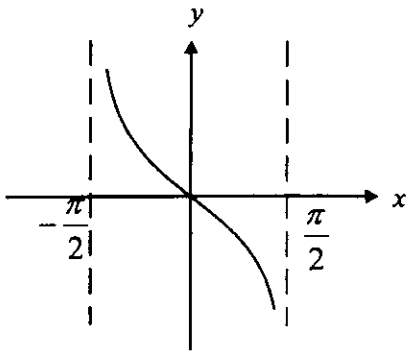
A.



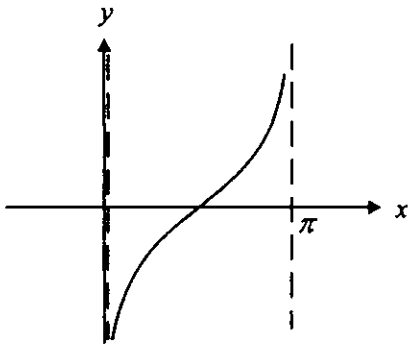
B.



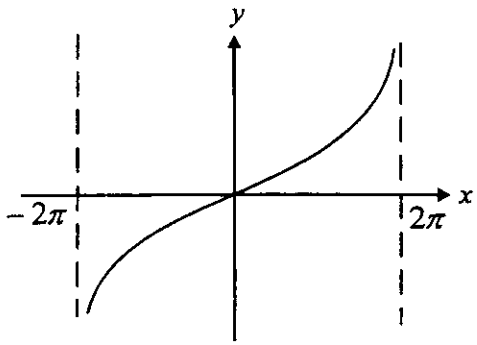
C.



D.

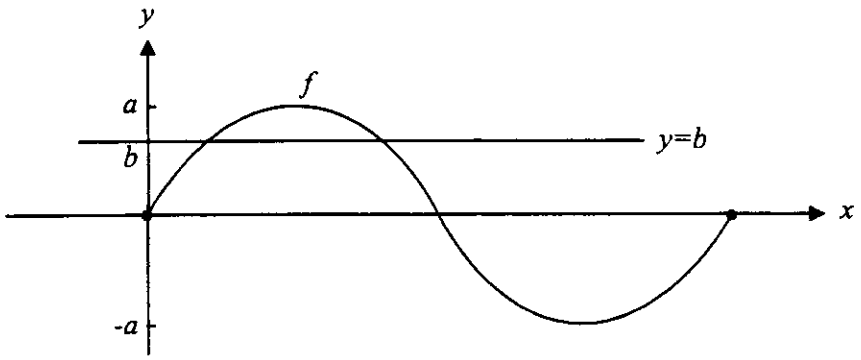


E.



Question 4

The graphs of the functions $y = f(x)$ where, $f : [0, \pi] \to R, f(x) = a\sin(2x)$ and $y = b$ are shown below.



The equation $a\sin(2x) = b$ will have no solutions if b is equal to

A. $-a$
B. 0
C. a
D. $-a$ or a
E. $a + 1$

Question 5

The coefficient of x^4 in the expansion of $(x+1)^8$ is

A. 4
B. 8
C. 35
D. 56
E. 70

Question 6

$\log_2 \frac{1}{4} - \log_2 32 + 2\log_2 1$ simplifies to give

A. –7
B. –6
C. $\log_2(6)$
D. $\log_2(7)$
E. 4

Question 7

The exact solution of the equation $4 \times 3^{3x+1} = 24$ is

A. $\frac{1}{3}$

B. $\log_{10} 2$

C. $3\log_{10}(3x+1)$

D. $\frac{1}{3}(-1+\log_{10} 2)$

E. $\frac{1}{3}\left(-1+\frac{\log_{10} 6}{\log_{10} 3}\right)$

Question 8

The graph of the function g crosses the x-axis at two points only. Which one of the following could be the rule for g?

A. $g(x)=(x+1)(x^2+1)$

B. $g(x)=(x-1)^2(x+1)^2$

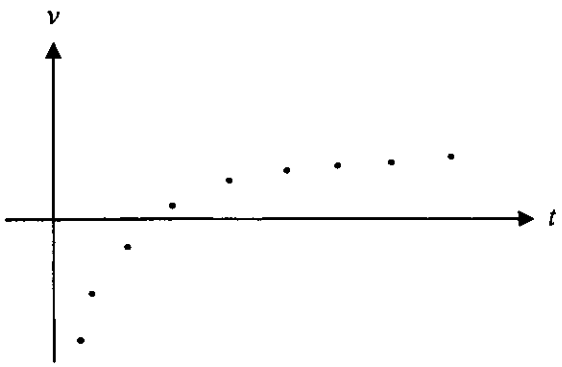
C. $g(x)=x(x+1)(x-1)$

D. $g(x)=(x-1)(x+1)(x+2)$

E. $g(x)=(x-1)(x+1)(x^2+1)$

Question 9

The graph of data representing the variables v and t is shown below.



The type of function which would model this data most simply would be

A. linear

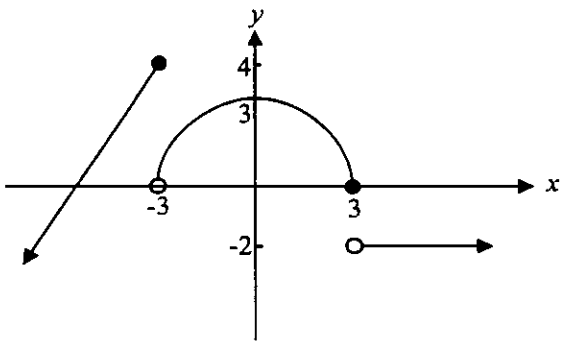
B. quadratic

C. logarithmic

D. decreasing

E. circular

Question 10
The graph of the function f is shown below.

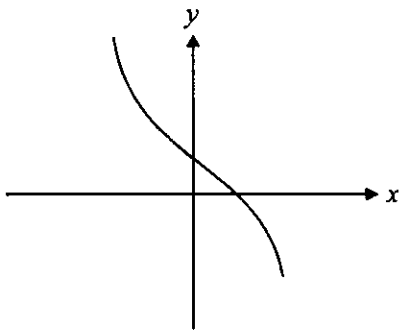


The domain and range of f are given by

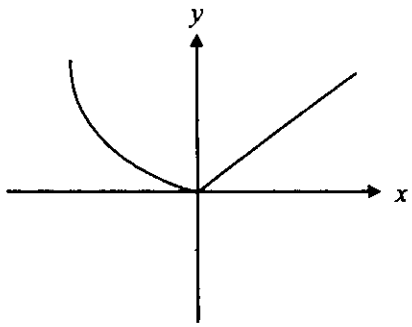
A.	$d_f = (-\infty, 4]$	$r_f = R$
B.	$d_f = R$	$r_f = (-\infty, 3]$
C.	$d_f = R$	$r_f = (-\infty, 4]$
D.	$d_f = (-\infty, 3]$	$r_f = (-\infty, -3) \cup (-3, 3) \cup (3, \infty)$
E.	$d_f = (-\infty, -3) \cup (-3, 3) \cup (3, \infty)$	$r_f = (-\infty, 4]$

Question 11
Which one of the following functions does not have an inverse function?

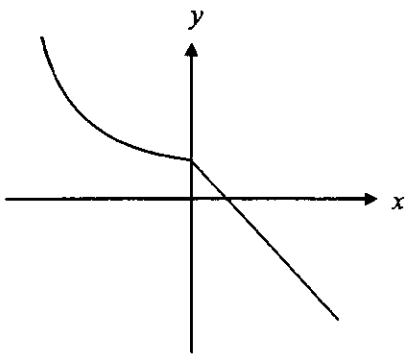
A.



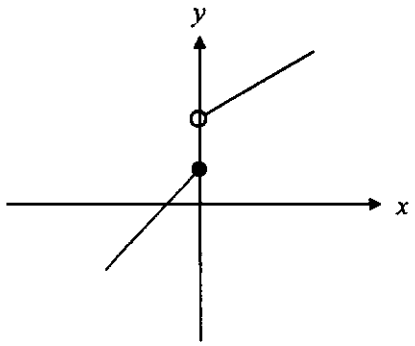
B.



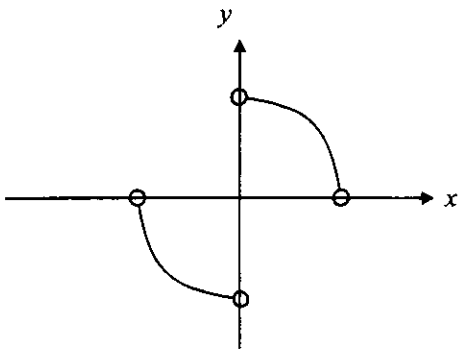
C.



D.



E.



Question 12

Which one of the following functions has a graph that does not include an asymptote?

A. $y=\dfrac{2}{x+1}$

B. $y=\sqrt{x-1}$

C. $y=e^{x+1}$

D. $y=\log_e(x-1)$

E. $y=x^{-2}$

Question 13

Given that $f(x+h)\approx f(x)+hf'(x)$ and $f(x)=\dfrac{1}{x}$, which one of the following gives an approximate value of $\dfrac{1}{10.01}$?

A. $f(0.01)+10f'(0.01)$

B. $f(0.1)+10f'(0.1)$

C. $f(0.1)+0.01f'(0.1)$

D. $f(10)+0.01f'(10)$

E. $f(10)+0.1f'(10)$

Question 14

The derivative of $\sqrt{x}\left(x^2+1\right)$ is

A. $\sqrt{x}$

B. $2\sqrt{x}$

C. $x+\dfrac{1}{2}$

D. $1+\dfrac{1}{2\sqrt{x}}$

E. $\dfrac{5x^{\frac{3}{2}}}{2}+\dfrac{1}{2\sqrt{x}}$

Question 15

If $y = \log_e(\sin(2x))$ then $\frac{dy}{dx}$ is equal to

A. $-2\tan(2x)$

B. $\frac{2}{\tan(2x)}$

C. $e^{2\cos(2x)}$

D. $\frac{-2\cos(2x)}{\sin(2x)}$

E. $\frac{\cos(2x)}{2\sin(2x)}$

Question 16

The instantaneous rate of change of the function $g(x) = x^5 e^{2x}$ at the point where $x = 1$ is

A. $\frac{e^2}{12}$

B. e^2

C. $7e^2$

D. $10e^2$

E. $12e^2$

Question 17

If $h(x) = \frac{x}{\sqrt{x+1}}$ then $h'(x)$ is equal to

A. $x+2$

B. $2\sqrt{x+1}$

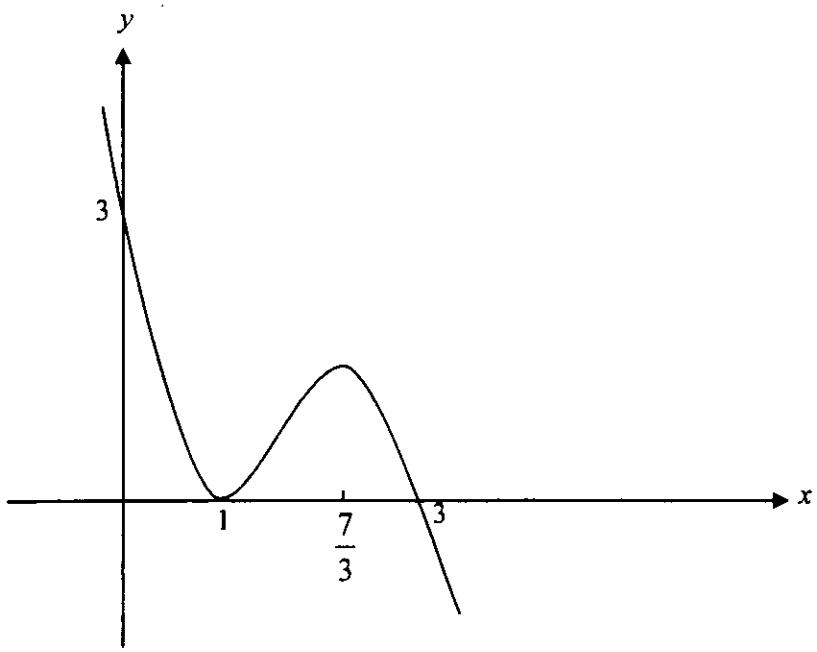
C. $\frac{x+2}{2(x+1)}$

D. $\frac{x}{\sqrt{x+1}(x+1)}$

E. $\frac{x+2}{2\sqrt{x+1}(x+1)}$

Question 18

The graph of the function $y = -x^3 + 5x^2 - 7x + 3$ is shown below.



For the function $f:[a,\infty) \to R$, $f(x) = -x^3 + 5x^2 - 7x + 3$ the maximum value occurs at $x = \frac{7}{3}$ if a is equal to

A. –2
B. 0
C. 1
D. 3
E. 5

Question 19

The area enclosed between the positive x-axis, the positive y-axis, the line $x = 2$ and the curve with equation $y = -(x-2)^2 + 5$ is approximated using the right rectangle method of approximation, and rectangles with a width of 1 unit.
The area found, in square units is

A. 1
B. 4
C. 5
D. 9
E. 10

Question 20

Given that c is a constant, $\int\left(2\sqrt{x}-e^{-2x}\right)dx$ is equal to

A. $\frac{1}{\sqrt{x}}+2e^{-2x}+c$

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

C. $3x^{\frac{3}{2}}+\frac{e^{-2x}}{2}+c$

D. $\frac{4x^{\frac{3}{2}}}{3}+\frac{e^{-2x}}{2}+c$

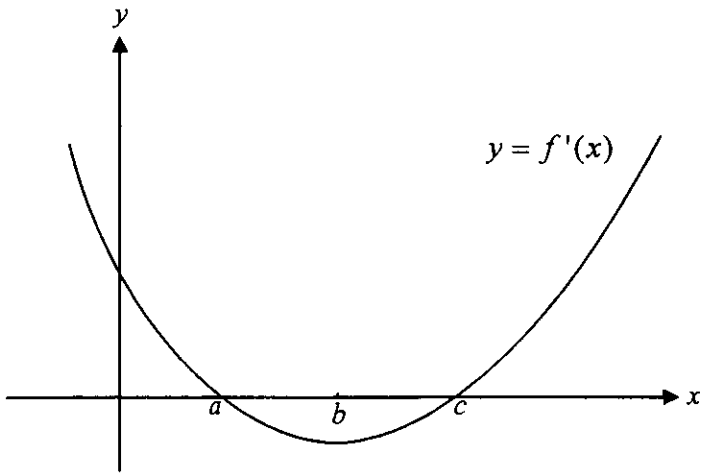
E. $\frac{4x^{\frac{3}{2}}}{3}+2e^{-2x}+c$

Question 21

Given that $\int_0^k(3x+2)^5\,dx=864\cdot5$, and $k>0$, the value of k is

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

Question 22



The graph above shows the graph of the function $y=f'(x)$.
For the graph of $y=f(x)$, it would **not** be true to say that

A. at $x=a$, the gradient is zero
B. for $x<0$, the gradient is positive
C. at $x=b$, there is a stationary point
D. for $a<x<c$, the gradient is negative
E. for $x<a$, the gradient is positive

Question 23

The probability distribution of the random variable X is shown in the table below.

X	0	1	2	3
$\Pr(X = x)$	0.1	0.3	0.4	0.2

The variance of X is

A. 0.81
B. 5.4
C. 5.5
D. 6.59
E. 6.69

Question 24

The head circumference of a group of 3 month old babies involved in a research trial is normally distributed with a mean of 40cm and a standard deviation of 1cm.
The probability that a randomly selected 3 month old baby from this research trial will have a head circumference between 38.5cm and 40.6cm is

A. 0.2075
B. 0.6589
C. 0.7257
D. 0.8143
E. 0.9332

Question 25

Given that Z is the standard normal variable with mean μ and standard deviation σ then it is true that

A. $\mu = \sigma$
B. $\mu + 1 = \sigma$
C. $\Pr(-1 < Z < 1) = 0.5$
D. $\Pr(Z < 0) = 1 - 2\Pr(Z > 0)$
E. $\Pr(Z < 2) = 2\Pr(Z < 1)$

Question 26

Colin is late for work thirty percent of the time. The probability that Colin is late for work twice over the next five mornings from Monday to Friday is given by

$$^5C_2(0 \cdot 3)^2(0 \cdot 7)^3$$

The mean and the variance of the number of times that Colin is late for work over the five mornings from Monday to Friday is given by

A. mean = 0.3 variance = 0.7
B. mean = 0.3 variance = 0.63
C. mean = 0.9 variance = 1.05
D. mean = 1.5 variance = 0.63
E. mean = 1.5 variance = 1.05

Question 27

For every five students who begin a particular tertiary course, only three go on to finish it four years later. In a random sample of ten students who begin this course the probability that at least eight of them will complete it four years later is given by

A. $(0.6)^8$

B. $1-{}^{10}C_8(0.6)^8(0.4)^2$

C. $(0.6)^8+(0.6)^9+(0.6)^{10}$

D. ${}^{10}C_8(0.6)^8(0.4)^2+4(0.6)^9+(0.6)^{10}$

E. $1-\left({}^{10}C_8(0.6)^8(0.4)^2+{}^{10}C_9(0.6)^9(0.4)^1+{}^{10}C_{10}(0.6)^{10}(0.4)^0\right)$

PART II

Question 1

a. Factorise the function $f(x)=-x^3+7x^2-11x+5$. (2)

b. Hence, without using calculus write down the coordinates of one of the turning points of the graph of $y=f(x)$. (1)

Question 2

Three of the twelve texta pens in Olivia's pencil case no longer work. Olivia randomly chooses two texta pens from her pencil case one after the other without replacement.

a. What is the expected number of texta pens that don't work out of these two? (1)

b. What is the probability that both of the texta pens chosen by Olivia won't work? (2)

Question 3

Find the solutions to the equation $\sin(3x)+2\cos(3x)=0$ for $0^\circ \le x \le 180^\circ$. (2)
Express your answer(s) to the nearest minute.

Question 4

Consider the function $f(x)=\sqrt{x}$.

a. Sketch the graph of $y=f(x)$ on the set of axes below. (1)

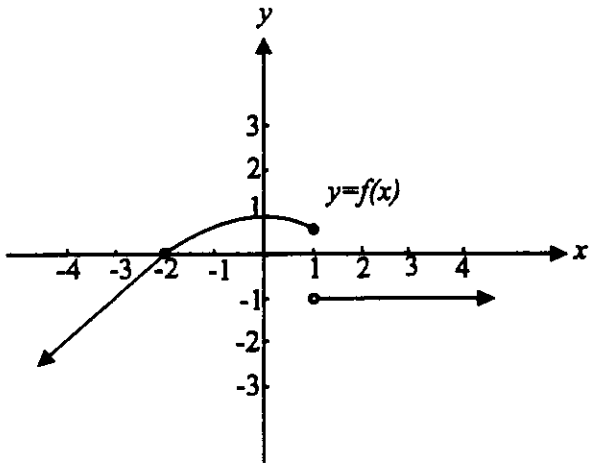
b. **i.** The graph of $y=f(x)$ is reflected in the y-axis to produce the function $h(x)$. Sketch the graph of $y=h(x)$ on the set of axes below. (1)

ii. Write down the rule for the function $h(x)$. (1)

c. The graph of $y=f(x)$ is dilated by a factor of 2 units parallel to the y-axis to produce the function $g(x)$. Sketch the graph of $y=g(x)$ on the set of axes below. (1)

Question 5

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



a. Write down the domain and range of the function f. (1)

b. Sketch the graph of $y = f'(x)$ on the set of axes below. (2)

Question 6

Find the equation of the normal to the graph of $y = 2\tan\left(\frac{x}{4}\right) + 1$ at the point where $x = \pi$. (4)

Question 7

Find the area of the two regions enclosed by the graphs of the functions $y = \cos\left(\frac{\pi x}{4}\right)$ and (4)

$y = e^{\frac{x}{2}} - e$, the line $x = 4$ and the y-axis. Express your answer as an exact value.