STUDENT EDUCATION NUMBER									

Government of Sāmoa

Sāmoa Secondary Leaving Certificate

MATHEMATICS

2016

QUESTION and ANSWER BOOKLET

Time allowed: 3 hours &10 minutes

INSTRUCTIONS:

1. You have 10 minutes to read **before** you start writing.
2. Write your **Student Education Number (SEN)** in the space provided on the top right hand corner of this page.
3. Answer **ALL QUESTIONS**. Write your answers in the spaces provided in this booklet.
4. If you need more space for answers, ask the Supervisor for extra paper. Write your SEN on all extra sheets used and clearly number the questions. Attach the extra sheets at the appropriate places in this booklet.

SECTION	Page number	Time (minutes)	Weighting
A. Multiple Choice	2	54	30
B. Extended Responses	15	126	70
TOTAL		**180**	**100**

CHECK! This booklet contains pages 2-29 in the right order.

YOU MUST HAND THIS BOOKLET TO THESUPERVISOR AT THE END OF THE EXAMINATION.

SECTION A MULTIPLE CHOICE WEIGHTING 30

QUESTION 1

Given the formula $V = \frac{2R}{R - r}$, which expression is true when the subject is changed to ***r.***

A. $R\left(1 - \frac{2}{V}\right)$

B. $R\left(\frac{2}{V} - 1\right)$

C. $R\left(\frac{2}{V} + 1\right)$

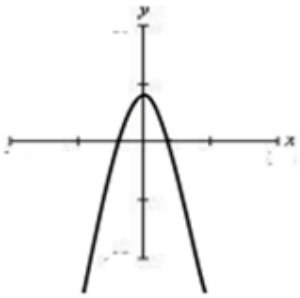
D. $R - \frac{2}{V}$

E. $\frac{2R}{V}$

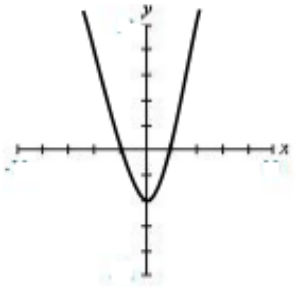
QUESTION 2

Which of the following graphs represents a cubic function?

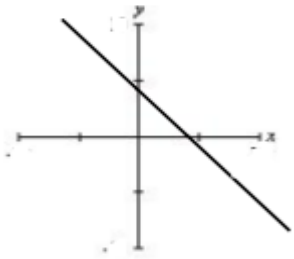
A.



B.



C.



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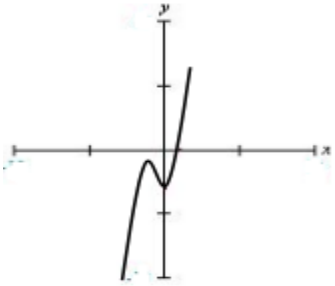
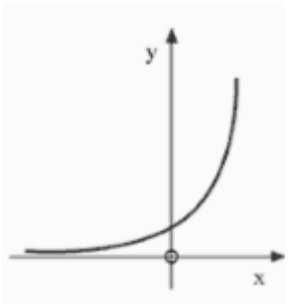
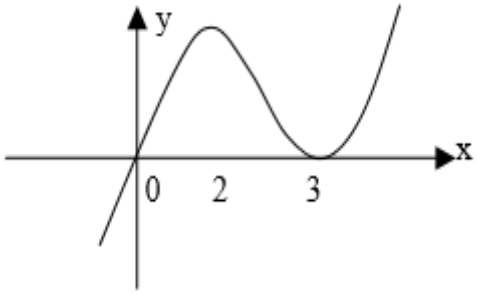


E.



QUESTION 3

The equation that best represents the graph below is:



A. $y = x(x-3)^2$

B. $y = x(x+3)^2$

C. $y = x(x-2)^2$

D. $y = x(x+2)^2$

E. $y = x(x-2)(x-3)$

QUESTION 4

In its simplest form $\frac{6-2x}{x-3} + \frac{x^2-4}{x+2}$ is equal

A. x

B. $x-4$

C. $x+4$

D. $-2x-2$

E. $-2x+4$

QUESTION 5

The law of index states that:

A. $a^m + b^n = a^m b^n$

B. $a^m - b^n = \frac{a^m}{b^n}$

C. $a^m \,.\, a^n = a^{m \times n}$

D. $\frac{a^m}{a^n} = a^{m \div n}$

E. $a^m \times a^n = a^{m+n}$

QUESTION 6

Which of the following statement is true?

A. $\log_a x$ is the log of a to base x

B. $\log_a a$ is the same as 0

C. $n \log a$ is the same as $\log a^n$

D. $\log u + \log v$ is simplified to $\log u \times v$

E. $\log u - \log v$ is the same as $\frac{\log u}{\log v}$

QUESTION 7

What are the coordinates of the x intercept of the line $2x + 4y - 8 = 0$?

A. (2, 0)

B. (4, 0)

C. (8, 0)

D. (-2, 0)

E. (0, 0)

QUESTION 8

Line AB has ***p*** as the x-intercept and ***2p*** as the y-intercept. Point (1,2) is also on the line AB. The value of ***p*** is:

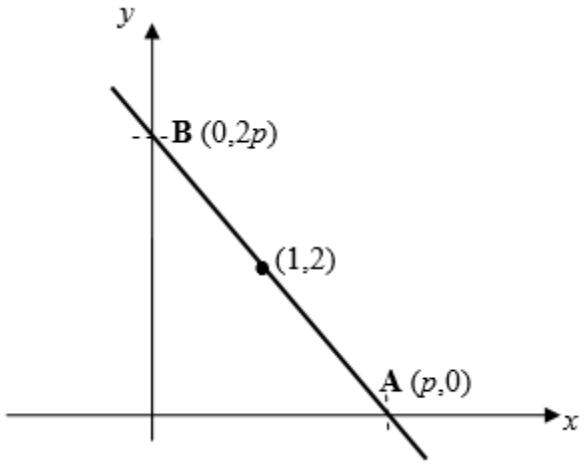
A. 0

B. 1

C. 2

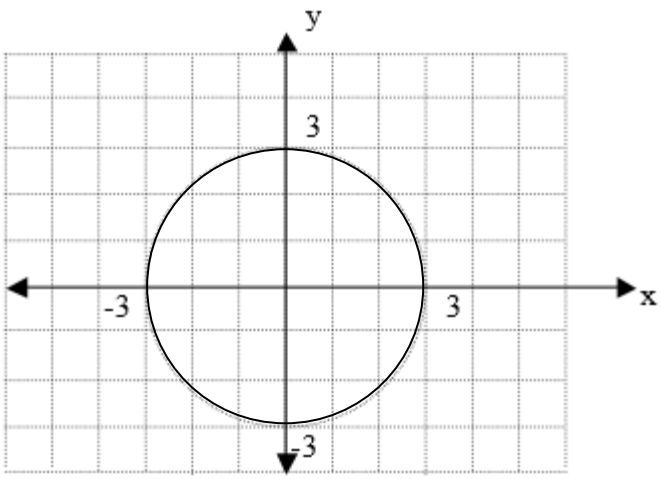
D. 3

E. 4



QUESTION 9

The graph below is that of a circle.



Which of these is the correct equation of the circle above?

A. $y^2 = x^2 + 3$

B. $y^2 + x^2 = 3$

C. $y^2 + x^2 = 3^2$

D. $(y-3)^2 + (x-3)^2 = 3$

E. $(y-3)^2 + (x-3)^2 = 3^2$

QUESTION 10

Which statement best describes two lines that are parallel?

A. Lines intersect each other at right angle

B. Lines which gradients are equal and intersect each other at 90^o

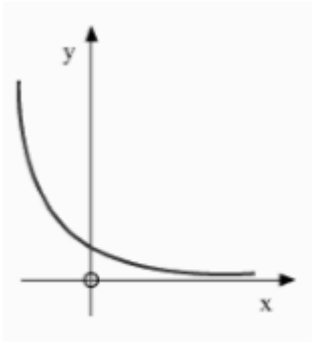
C. Lines that have the same gradient but never meet

D. The product of the gradient of the two lines is -1

E. The two lines slopes to the same direction and have different gradient

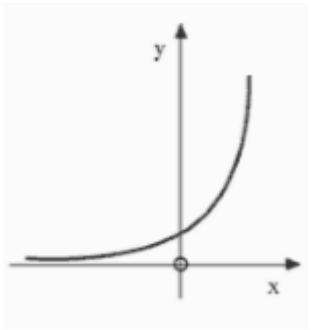
QUESTION 11

Function f is

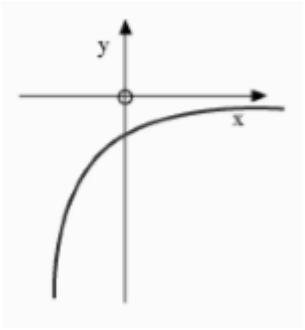


The inverse of the function f shown above is best represented by

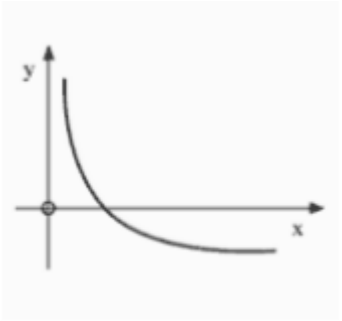
A.



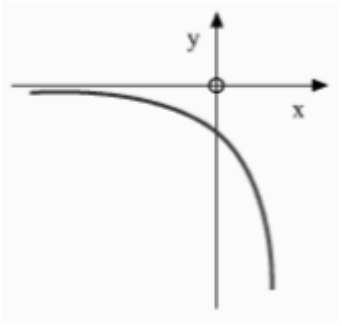
B.



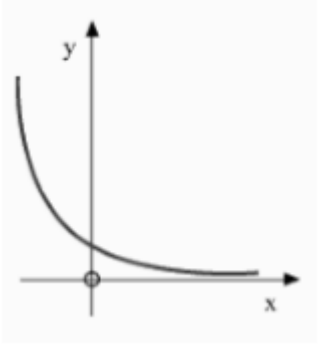
C.



D.



E.



QUESTION 12

Which of the following statement is NOT true for $g(x) = 3x^2 + 6x + 5$?

A. $g(x) = 3(x+1)^2 + 2$

B. $g(x)$ has a minimum turning point at (-1, 2)

C. $g(x)$ has an axis of symmetry at x =1

D. The minimum value of the function is 2

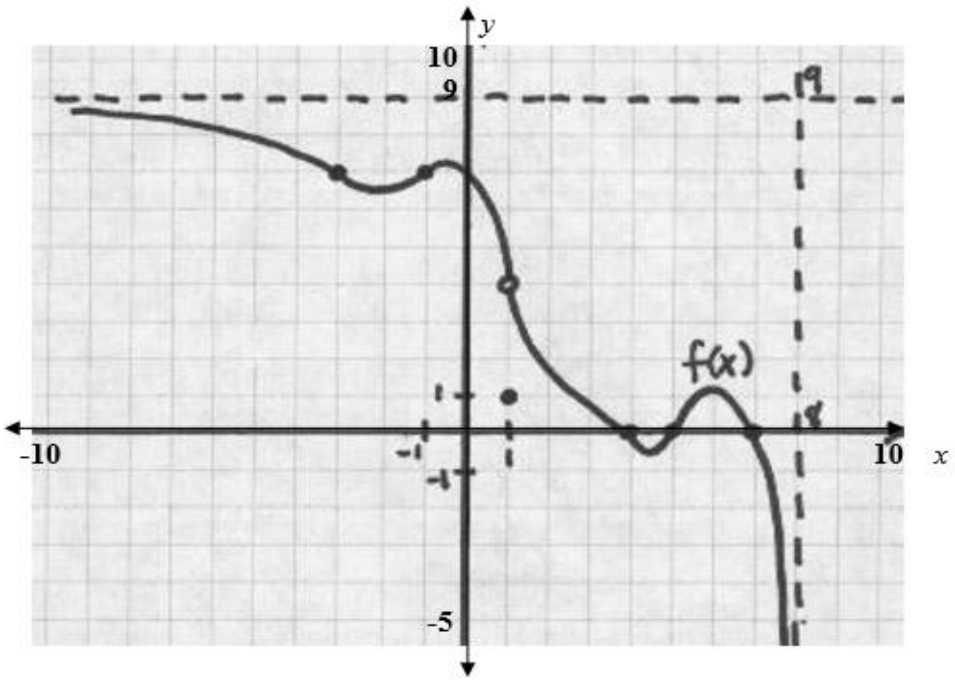
E. All statements are not true.

QUESTION 13

Shown below is Tito's sketch of the function $y = f(x)$ throughout a square-unit grid.

Which of the following is NOT true about the nature of the function $y = f(x)$?

(Please observe the graph carefully.)



A. f has domain (–∞, 8)

B. $f(4) = f(5) = f(7)\ and\ f(-1) = f(-3)$

C. $f(-1) > f(-2)$

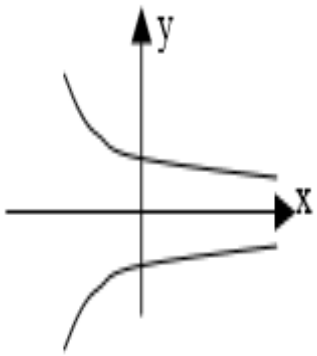
D. f has range (– ∞ , 9)

E. The limit of $f(x)$, as x approaches 1, is 4

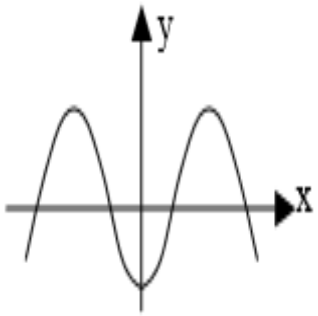
QUESTION 14

Which of these is the graph of the function represented by $y = \frac{Ax+B}{Cx+D}$?

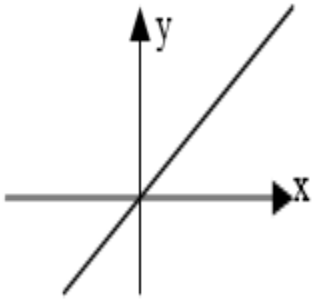
A.



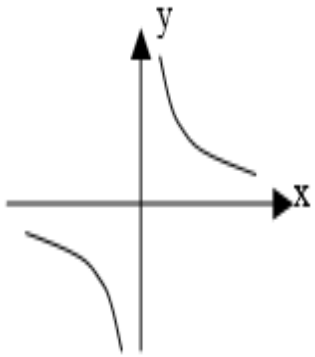
B.



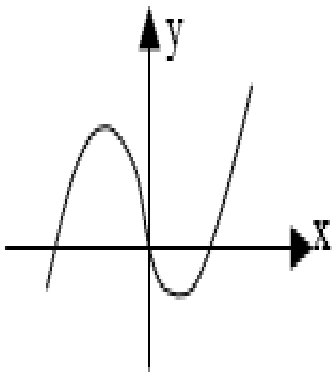
C.



D.



E.



QUESTION 15

Which statement best defines the ***Limit of a function***?

A. Limit of a function, f is the value of that function f approaches as x tends to a particular value.

B. It is the definite integral of function f

C. The limit of a function is the vertex of the function

D. Limit of a function is the point where the function increases

E. It is the point of inflexion of the graph of f

Use the following information to answer Questions 16 to 18.

The common difference, $\boldsymbol{d}$, of a sequence is half of the first term, $\boldsymbol{a_1}$. The 12th term of the sequence is 169.

QUESTION 16

What is the first term, $\boldsymbol{a_1}$, of the sequence given above?

A. 31 B. 14

C. 26 D. 11

E. 24

QUESTION 17

The value of the common difference, $\boldsymbol{d}$ of the above sequence is:

A. 14 B. 11

C. 15 D. 18

E. 13

QUESTION 18

The $\boldsymbol{nth}$ term of the sequence is given by

A. $T_n = 31 + (n-1)11$

B. $T_n = 14n + 17$

C. $T_n = 11(1+n)$

D. $T_n = 13(1+n)$

E. $T_n = 26(1-n)$

QUESTION 19

Two events A and B are complementary events. If $P(A) = q$, then

A. $P(B) = q$

B. $P(B) = -q$

C. $P(B) = 1 + q$

D. $P(B) = 1 - q$

E. $P(B) = q - 1$

QUESTION 20

If two events are independent, then

A. they must be mutually exclusive

B. the sum of their probabilities must be equal to one

C. their intersection must be 0

D. the product of their probabilities must be equal to the probability of their intersection

E. all of the above

QUESTION 21

Which of the following statement is true?

A. Equiprobable occurs when every element of a sample space has an equal likelihood of occurring.

B. A set whose elements describe every possible outcome of a trial is called event

C. Two events, E_1 and E_2, are mutually exclusive if it is possible for them to occur together

D. A probability of 0 means there is a possibility that an event will occur

E. Event A is independent of event B because the outcome of event A has an effect on event B.

Question 22

A bell-shaped curve that describes the distributions of data is a:

A. bell curve

B. standard curve

C. normal curve

D. Slanted curve

E. deviant curve

Question 23

A random variable $\boldsymbol{X}$ has a mean of $\boldsymbol{\mu}$ and a standard deviation of $\boldsymbol{\sigma}$ can be transformed into a random variable $\boldsymbol{Z}$, which has a

A. mean of 1 and a standard deviation of 0.5

B. mean of -1 and a standard deviation of 0

C. mean of 0.5 and a standard deviation of 1

D. mean of 0 and a standard deviation of 1

E. mean of 0 and a standard deviation of 0.5

Question 24

If $P(E)$ is the probability that an event will occur, then which of the following must be false?

A. P(E) = 1
P(E) = $\frac{1}{2}$
C. P(E) = $\frac{1}{4}$
P(E) = 0
D. P(E) = -1

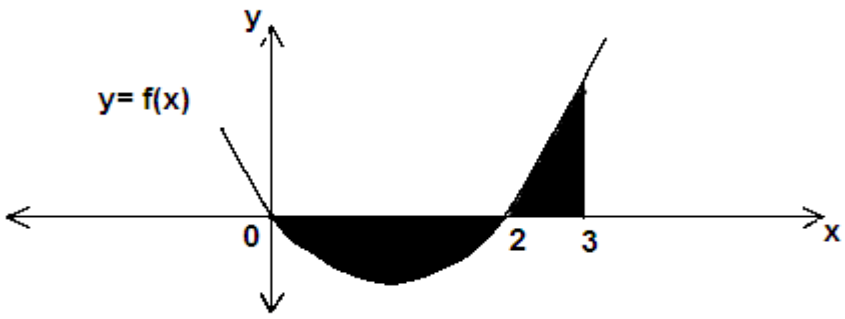
Question 25

A line that intersects two points, AB, on the curve f is called

A. derivative of the function f
B. secant line of the graph of f
C. tangent line of the graph of f
D. continuity of the function f at a number and on an interval
E. normal to the tangent of the graph of f

Question 26

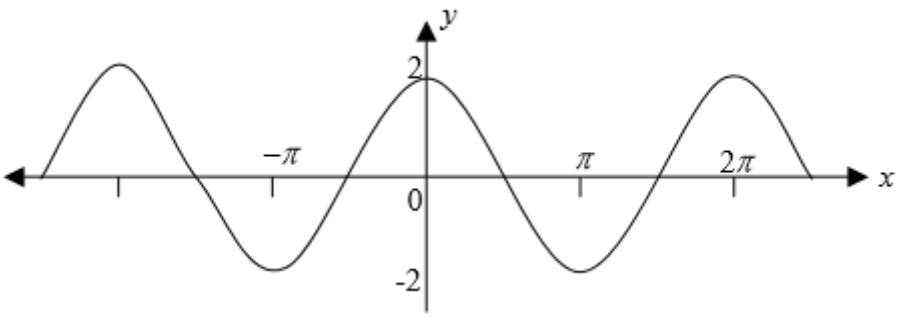
Which of these correctly expresses the area bounded by the curve $y = f(x)$ and the x-axis between $x = 0$ and $x = 3$?



A. $\int_0^3 f(x)dx$
B. $\int_0^2 f(x)dx + \int_2^3 f(x)dx$
C. $\left|\int_0^3 f(x)dx\right|$
D. $\left|\int_0^2 f(x)dx + \int_2^3 f(x)dx\right|$
E. $\left|\int_0^2 f(x)dx\right| + \left|\int_2^3 f(x)dx\right|$

Question 27

The graph is that of a periodic function



The period of the function is

A. 2

B. 4

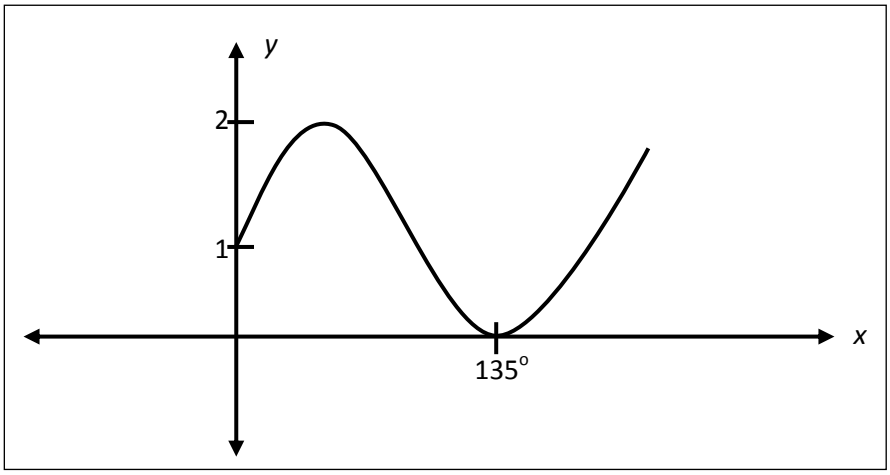
C. $\frac{\pi}{2}$

D. π

E. 2π

Question 28

The graph below could be represented by



A. $y = 2\sin x$

B. $y = 1 + 2\sin x$

C. $y = \cos(2x + 1)$

D. $y = 1 + \sin 2x$

E. $y = \sin(2x + 1)$

Question 29

Compared to the graph of $y = \sin\theta$, the graph of $y = \sin 2\theta$ has the same

A. amplitude, but double the period

B. period, but double the amplitude

C. amplitude, but half the period

D. period, but half the amplitude

E. amplitude, but shift 2 units to the left

Question 30

The expression$(1 + \cos\theta)(1 - \cos\theta)$ is equivalent to

A. 1

B. $sec^2\theta$

C. $sin^2\theta$

D. $cosec^2\theta$

E. $cot^2\theta$

SECTION B **EXTENDED RESPONSES** **WEIGHTING 70**

INSTRUCTION: SHOW ALL CALCULATIONS CLEARLY

QUESTION 1: WEIGHTING 14

a. Expand and simplify $(x + 1)(x - 2)^2$

Skill Level 2

b. Simplify $2log\ a - log\ ab$

Skill Level 2

c. If $(x - 1)$ is a factor of $f(x)$ where $f(x) = x^3 + 2x^2 - x - 2$, find the other two factors of $f(x)$

Skill Level 3

d. Solve $e^{2x-1} = 3.4$

Skill Level 3

e. Dan borrowed \$1 800 tala from his parents in the beginning of his study
His parents reduce the amount he owes by 40% at the end of that year, and each subsequent year he continues his studies.
Dan studies for several years and he does not make repayments of the initial amount while he is studying.
The amount ***\$A*** he owes his parents if he studies ***n*** number of years is given by the expression

$$\$A = 1800 \times (0.6)^n$$

Find the minimum number of years for which Dan studies if he owes his parents less than \$100 when he finishes studies.

Skill Level 4

QUESTION 2:

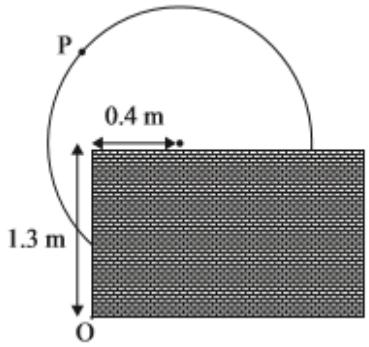
a. Show that the distance between the points A(a, b) and B(c, d) is the same as the distance between the points C(a, d) and B(c, d).

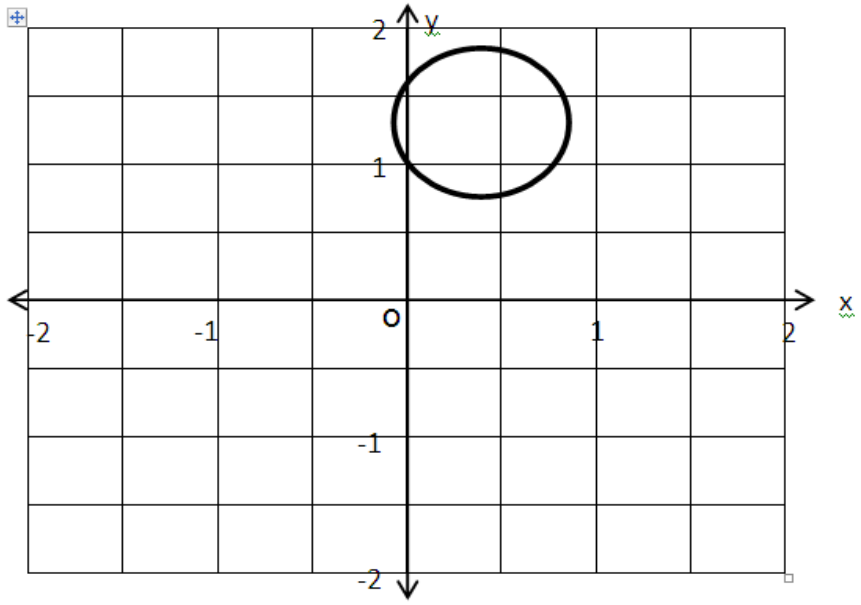
Skill Level 2

b. Find the equation of the perpendicular bisector of the line segment joining the points - (1, 1) and (2, 4)

Skill Level 3

c. A wheel rotates vertically around an axle.
The axle is located as shown from the bottom left corner of a wall.
The radius of the wheel is 0.5m
A point P is on the circumference of the wheel.
The position of point P relative to the point **O** as the wheel rotates is shown on the graph.

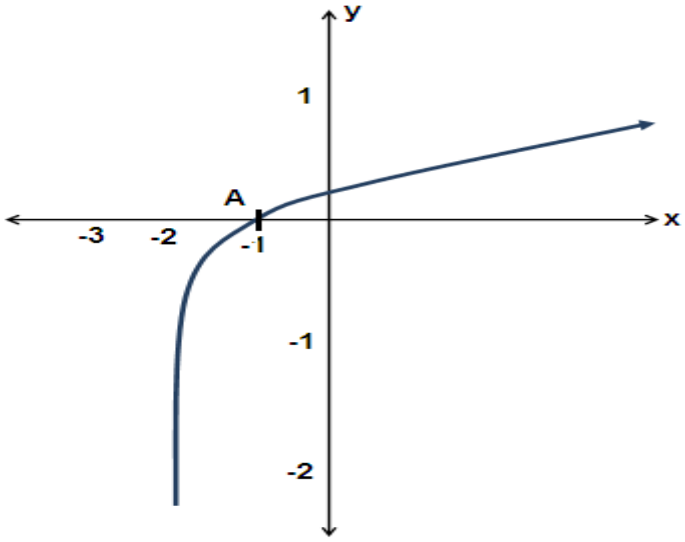




(i) Give the equation of the circle.
(ii) Use the equation in part (i) to find the horizontal distance from the left hand end of the wall when P is 1.1m above.

Skill Level 4

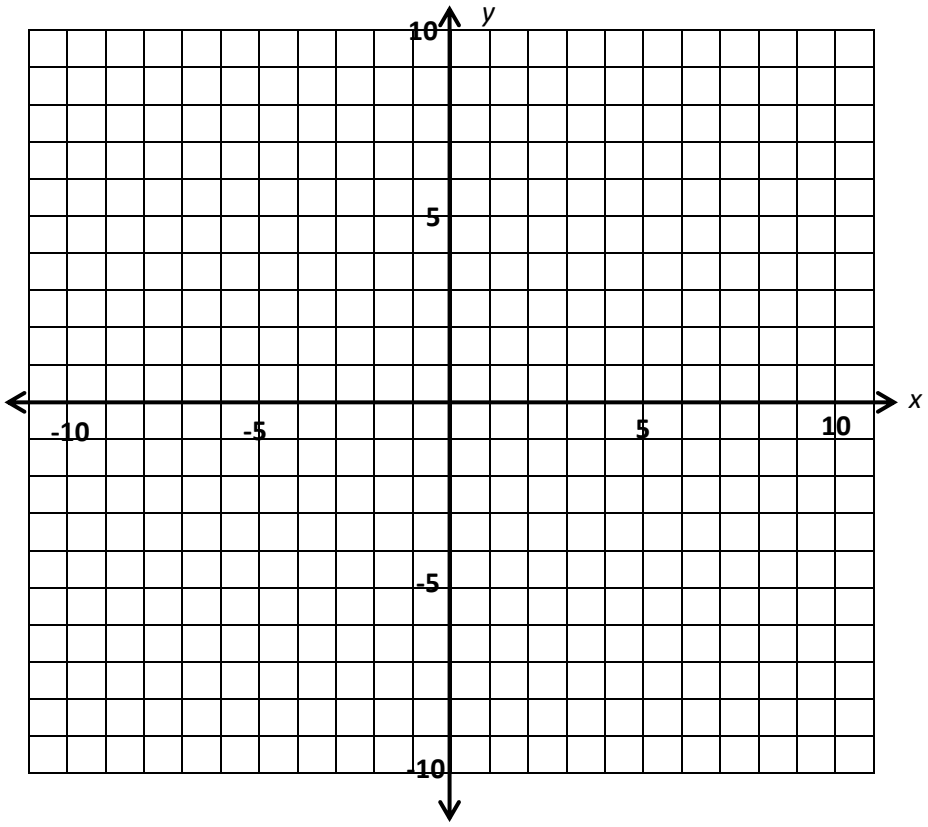
d. The graph of the function $f(x) = \log_{10}(x + 2)$ is shown below.



Determine the domain and range of the function $f(x)$

	Skill Level 2

e. Draw the graph of $y = \frac{1}{x - 1} + 3$.
Clearly show any key features



Skill Level 3

QUESTION 3:

a. Find a_n if $S_4 = \frac{26}{27}$ and $r = \frac{1}{3}$

Skill Level 2

b. A display of cans on a grocery shelf consists of 20 cans on the bottom, 18 cans in the next row, and so on until the top row has 4 cans. How many cans, in total are in the display?

Skill Level 3

c. If the 6^{th} term of a geometric sequence is 972 and the 9^{th} term is 26244. Find the 1^{st} term, the common ratio and the sum of the first 10 terms.

Skill Level 4

d. The probability that it is Friday and that a student is absent is 0.3, since there are 5 school days in a week.Calculate the probability that a student is absent given that today is Friday.

Skill Level 2

e. The time taken for a lecturer to bore her audience to sleep was measured. The average time was 7 minutes, with a standard deviation of 2 minutes. What is the minimum time that the audience stayed awake for the most interesting 10% of lectures?

Skill Level 3

QUESTION 4:

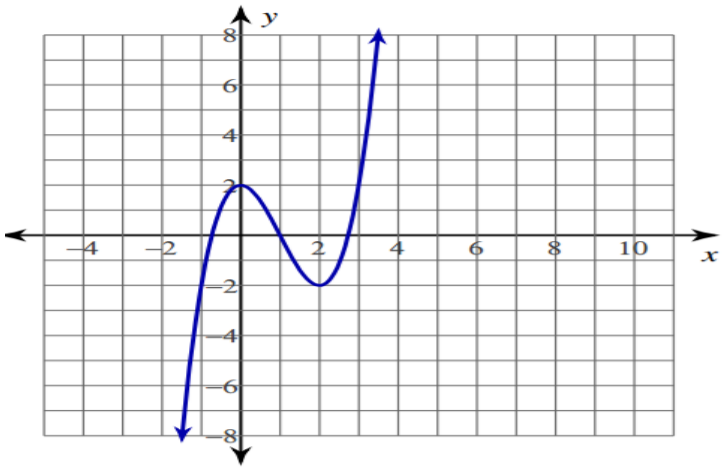
a. Find the derivative of $y = -\frac{1}{4}x^8 + \frac{1}{2}x^4 - 3^2$

Skill Level 2

b. Use the second derivative test to determine whether the nature of the turning point of the function $g(x) = 5 - x^2$ is a minimum, maximum or neither.

Skill Level 2

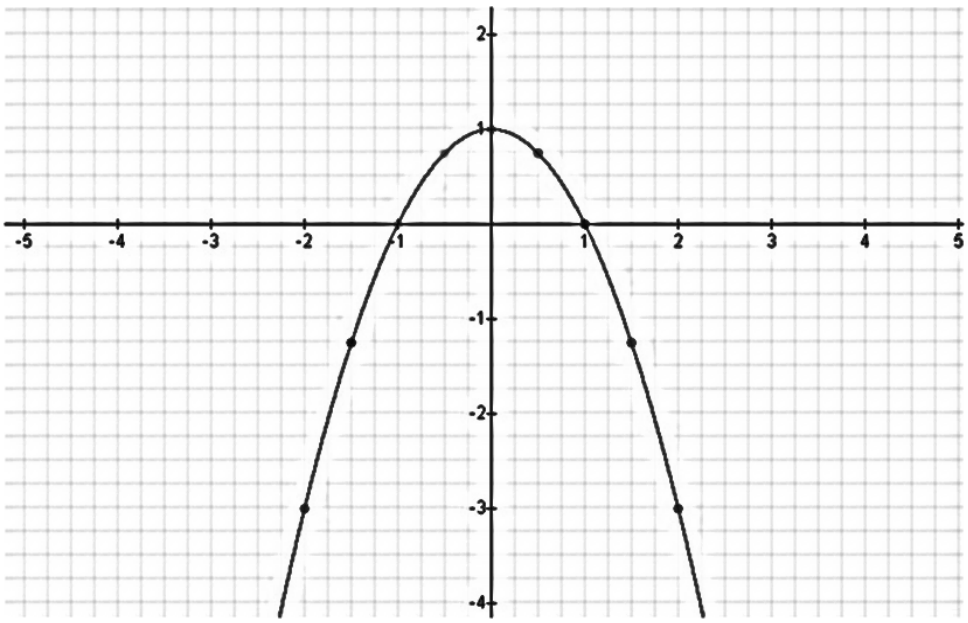
c. Find the equation of the line tangent to the function $y = x^3 - 3x^2 + 2$ at (3, 2)



Skill Level 3

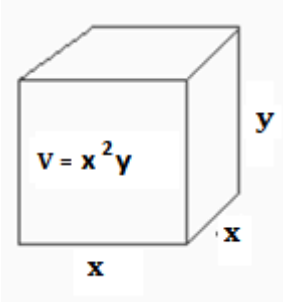
d. The figure below shows the graph of $y = -x^2 + 1$

Find the area enclosed between the graph $y = -x^2 + 1$ and the x-axis.



Skill Level 3

e. A box having a square base and an open top is to contain 108 cubic feet. What should its dimensions be so that the material to make it will be a minimum? *(Hint: Find the Total Surface Area)*



Skill Level 4

QUESTION 5:

a. Determine the period and amplitude of the trigonometric function:

$$y = 2 + 3\,Sin\left(4x + \frac{\pi}{2}\right)$$

Skill Level 2

b. Simplify $\frac{\sec x - \cos x}{\sec x}$

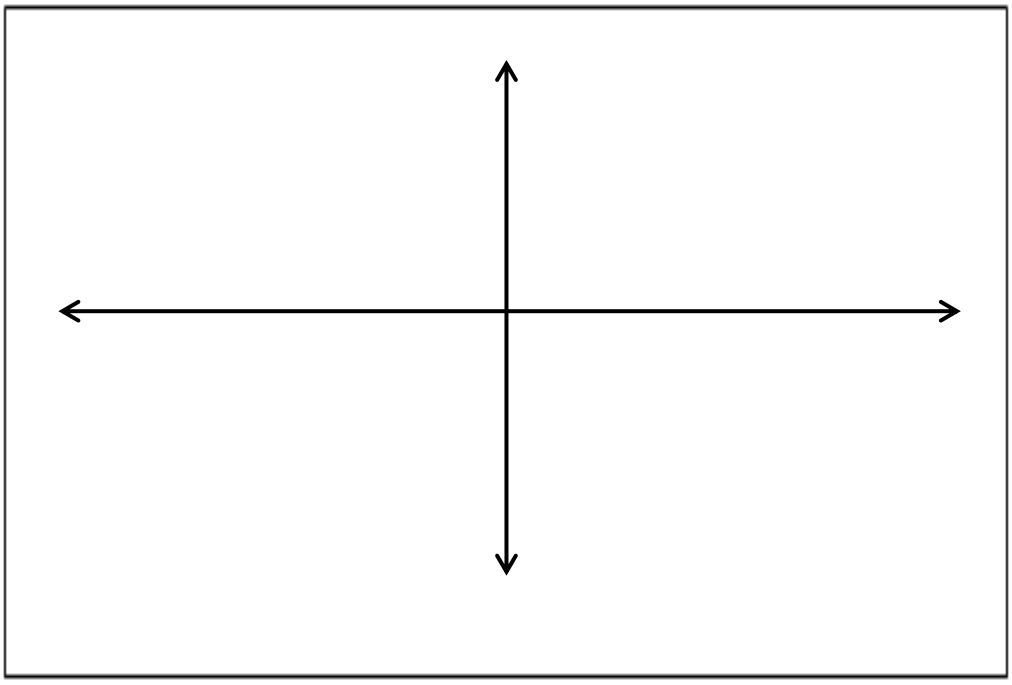
Skill Level 2

c. Solve for $0^{\circ} \leq x \leq 360°$

$$\sqrt{2}\ Sin\ 2x = 1$$

Skill Level 3

d. Graph the function $y = Cos\left(2x - \frac{\pi}{2}\right)$(using radians) over two periods, one in the positive direction and one in the negative direction.



Skill Level 3

e. Prove that $\frac{\cot x}{\operatorname{cosec} x} = \cos x$

Skill Level 4