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 QUESTION 1

Given the function

$$f(x) = -x^2 - 1$$

, what do the tables of values below help you to find?

First Point	Second Point	m_{sec}
$(1, -2)$	$(0, -1)$	-1
$(1, -2)$	$(0.9, -1.81)$	-1.9
$(1, -2)$	$(0.99, -1.98)$	-2

First Point	Second Point	m_{sec}
$(1, -2)$	$(2, -5)$	-3
$(1, -2)$	$(1.1, -2.21)$	-2.1
$(1, -2)$	$(1.01, -2.02)$	-2

Note:

 m_{sec}

is the slope of the secant passing through the first and second points.

 The slope of the curve at $(1, -2)$   is -2  .

 QUESTION 2

Given below is the function

$$f(x) = \frac{x^2 - 9}{x + 3}$$

. What do the tables of values below help you to find?

x	$f(x)$
-3.1	-6.1
-3.01	-6.01
-3.001	-6.001

x	$f(x)$
-2.9	-5.9
-2.99	-5.99
-2.999	-5.999



$$\lim_{x \rightarrow 3} f(x) = -6$$



$$\lim_{x \rightarrow -6} f(x) = -3$$



$$\lim_{x \rightarrow -3} f(x) = -6$$



$$\lim_{x \rightarrow -6} f(x) = 3$$

QUESTION 3



Select the correct answer from the drop-down menu.

The **Method of Bisection**   helps to locate the zeros of a function and give an approximation of these zeros.

QUESTION 4



Using

$$\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$$

, find

$$\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$$

.

Drag and drop in the spaces provided to complete the solution.

$\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2} =$	Given
$\lim_{x \rightarrow 0} \left(\frac{1 - \cos x}{x^2} \right) \left(\frac{1 + \cos x}{1 + \cos x} \right) =$ 	Multiply by $1 + \cos x$
$\lim_{x \rightarrow 0} \left(\frac{1 - \cos^2 x}{x^2} \right) \cdot \left(\frac{1}{1 + \cos x} \right) =$ 	Use the identity $a^2 - b^2$
$\lim_{x \rightarrow 0} \frac{\sin^2 x}{x^2} \cdot \frac{1}{1 + \cos x} =$ 	Use Trigonometric Identity
	properties of limit

$$\lim_{x \rightarrow 0} \left(\frac{\sin x}{x} \right)^2 \cdot \lim_{x \rightarrow 0} \frac{1}{1 + \cos x} = \checkmark$$

$$\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2} = 1 \cdot \frac{1}{2} = \frac{1}{2} \checkmark$$

$$\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$$

and

$$\lim_{x \rightarrow 0} \frac{1}{1 + \cos x} = \frac{1}{2}$$

$$\lim_{x \rightarrow 0} \left(\frac{1 + \cos^2 x}{x^2} \right) =$$

$$\lim_{x \rightarrow 0} \frac{1 + \cos x}{x^2} = 2$$

QUESTION 5



$$\lim_{x \rightarrow \infty} x \left(\sin \frac{1}{x} \right) =$$

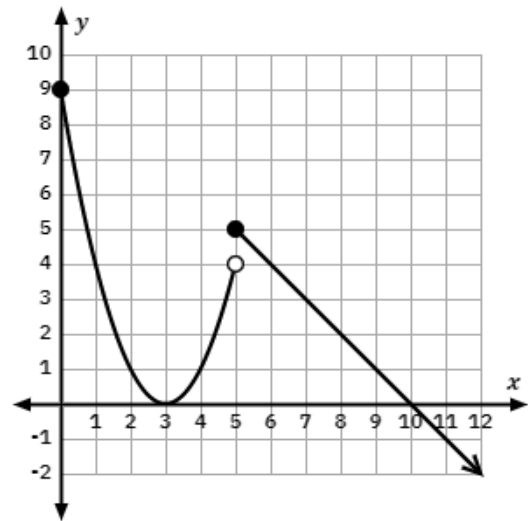
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QUESTION 6



The reason why the function whose graph is given does not have a limit at 5 is

$$\lim_{x \rightarrow 5^-} f(x) \neq \lim_{x \rightarrow 5^+} f(x) \checkmark$$



$$\lim_{x \rightarrow 5^+} f(x)$$

does not exist

$$\lim_{x \rightarrow 5} f(x) \neq f(5)$$

$$f(5)$$

does not exist

QUESTION 7



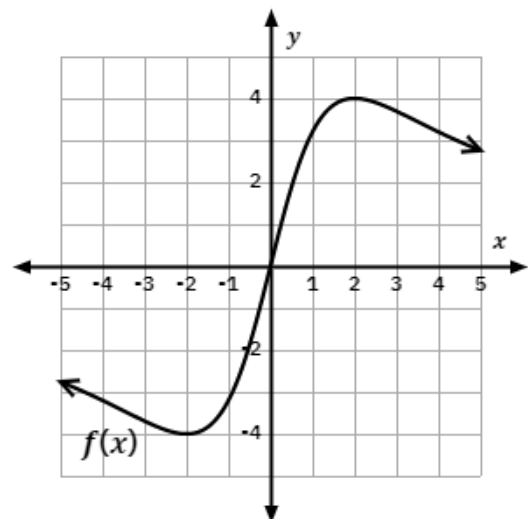
Using the graph of the function

$$f(x)$$

find

$$\lim_{x \rightarrow 2} \sqrt{f(x)} =$$

2



QUESTION 8



The graph represents the function

$$f(x) = \cos\left(\frac{\pi}{2}x\right)$$

with

$$0 \leq x \leq 2 \text{ and } -0.5 \leq y \leq 0.5$$

. Find a

$$\delta > 0$$

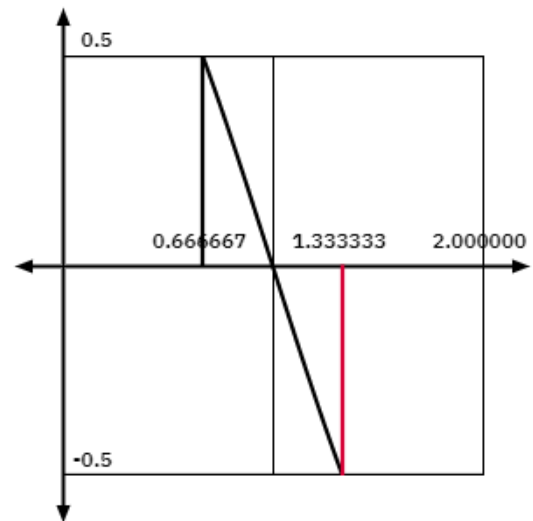
corresponding to an

$$\varepsilon = \frac{1}{2}$$

for

$$\lim_{x \rightarrow 1} \cos\left(\frac{\pi}{2}x\right) = 0$$

.



$$\delta \approx 1.666667$$



$$\delta \approx 0.666667$$

☒
$$\delta \approx 0.333333$$





$$\delta \approx 1.333333$$

QUESTION 9



Fill in the blank to correctly complete the sentence.

If

$$f(x) = e^{\frac{1}{x}}$$

where

$$x \in]-\infty, 0)$$

is extended continuously to a new function

$$g(x) = \begin{cases} e^{\frac{1}{x}}, & x < 0 \\ a, & x = 0 \end{cases}$$

, then

$a =$



QUESTION 10



Below is the table of values of a continuous function

$f(x)$.

x	-3	-2	-1	0	1
$f(x)$	25	6	25	-2	-3

Fill in the blank to correctly complete the sentence.

By the intermediate value theorem, there exists

c

in the interval

$[a, b]$

such that

$$f(c) = -2.5.$$

$a =$

0



and

$b =$

1



, where

a

and

b

are two consecutive integers.

QUESTION 11

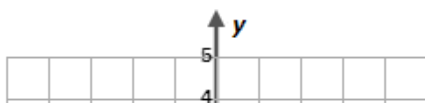
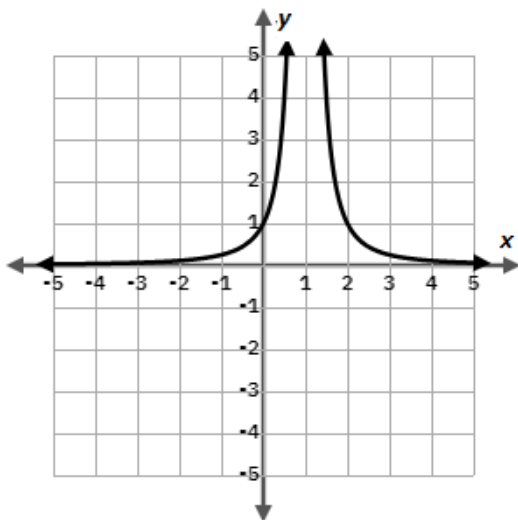
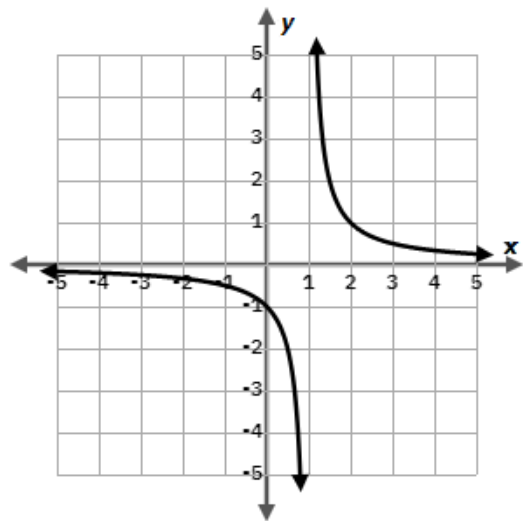
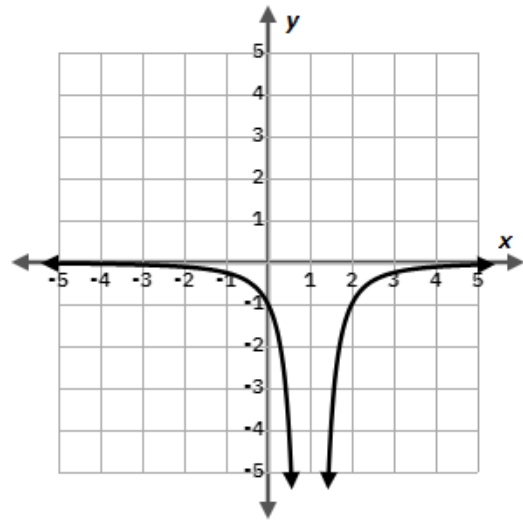


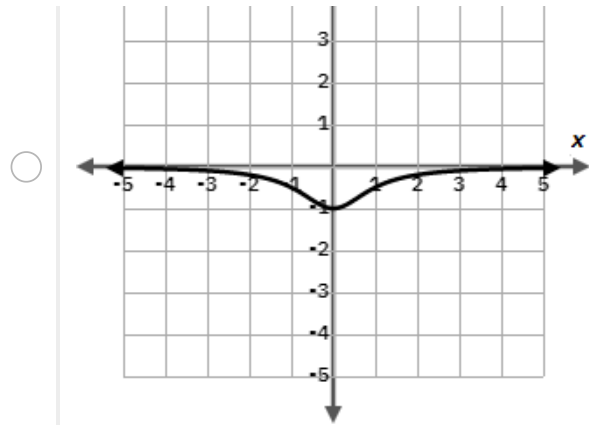
Which graph represents the function

$f(x)$

satisfying the listed set of characteristics?

- $\lim_{x \rightarrow 1^-} f(x) = -\infty$ and $\lim_{x \rightarrow 1^+} f(x) = -\infty$
- $\lim_{x \rightarrow -\infty} f(x) = 0$ and $\lim_{x \rightarrow \infty} f(x) = 0$





QUESTION 12



Find

$$\lim_{x \rightarrow 5} \frac{|x - 5|}{x - 5}$$

.

☐ 1

☐ -1

☒ Does not exist

☐ 5

QUESTION 13



Given the function

$$f(x) = -x^3 - 2x^2$$

, find the following limits:

$$\lim_{x \rightarrow \infty} f(x) =$$



$$\lim_{x \rightarrow 2} f(x) =$$



QUESTION 14



Batool used the property "the limit of a product is the product of limit" to find

$$\lim_{x \rightarrow 0} x(\csc x)$$

.

$$\begin{aligned} \lim_{x \rightarrow 0} x(\csc x) &= \left(\lim_{x \rightarrow 0} x \right) \left(\lim_{x \rightarrow 0} \csc x \right) \\ &= \left(\lim_{x \rightarrow 0} x \right) \left(\lim_{x \rightarrow 0} \frac{1}{\sin x} \right) \\ &= 0 \cdot (\pm \infty) \\ &= 0 \end{aligned}$$

I with Batool.

In case you do not agree, give a reason:

the reason is that

$$\lim_{x \rightarrow 0} \csc x$$



so the limit of product property does not hold.

QUESTION 15



The function

$$f(x) = \sqrt[3]{5x + 6}$$

has a root between

-2

and

-1

. The first step of the method of bisections is shown. What is the third approximation of this zero?

Without rounding, fill in the blank to correctly complete the sentence.

	a	m	b	
x	-2	-1.5	-1	
$f(x)$	-1.587	-1.144	1	

The third step approximates the zero to



QUESTION 16



A student claimed that by using the IVT theorem for the function

$$f(x) = \frac{2}{3-x}$$

, there exists a number

c

in the interval

$[1, 4]$

such that

$$f(c) = 0$$

, since

$$f(4) < 0 < f(1)$$

.

Is the student incorrect or is the student correct? Justify your answer.

Select the correct answer from the drop-down menu.

The student is incorrect because

is not continuous on



QUESTION 17



Hamda was asked to find

$$\lim_{x \rightarrow 5} \frac{x - 5}{\sqrt{x + 20} - 5}$$

. Her work is shown below.

$$\begin{aligned} \lim_{x \rightarrow 5} \frac{x - 5}{\sqrt{x + 20} - 5} &= \lim_{x \rightarrow 5} \frac{5 - 5}{\sqrt{5 + 20} - 5} \\ &= \lim_{x \rightarrow 5} \frac{0}{\sqrt{25} - 5} \\ &= \lim_{x \rightarrow 5} \frac{0}{5 - 5} \\ &= \lim_{x \rightarrow 5} \frac{0}{0} \\ &= 1 \end{aligned}$$

The teacher was not satisfied with Hamda's solution because

$$\lim_{x \rightarrow 5} \frac{x - 5}{\sqrt{x + 20} - 5} =$$

10



QUESTION 18



Given the function

$$f(x) = \frac{1}{x-2}$$

, complete the following:

$$\lim_{x \rightarrow 2^-} f(x) =$$



$$\lim_{x \rightarrow 2^+} f(x) =$$



$$\lim_{x \rightarrow \pm \infty} f(x) =$$



The asymptotes of the graph of $f(x)$

are

$x =$



and

$y =$



QUESTION 19



Choose the **two** correct conditions that make the function f

continuous on the closed interval $[a, b]$.

If the function

f

is continuous at every point of the open interval
 (a, b) .



$$f(a) = f(b)$$



$$\lim_{x \rightarrow a^-} f(x) = \lim_{x \rightarrow b^+} f(x)$$



$$\lim_{x \rightarrow a^+} f(x) = f(a) \text{ and } \lim_{x \rightarrow b^-} f(x) = f(b)$$



$$\lim_{x \rightarrow a^-} f(x) = f(a) \text{ and } \lim_{x \rightarrow b^+} f(x) = f(b)$$



$$f(a) \cdot f(b) < 0$$

QUESTION 20



Fill in the blank using

$<$, $>$, $=$, or NA,

to correctly complete the sentence. ('NA' means 'not applicable')

If

f

is continuous on the closed interval

$[a, b]$

and

$$f(a) \cdot f(b)$$

<



0, then there exists at least a number

 c

for which

$$f(c) = 0.$$

QUESTION 21



The precise definition of a limit states the following:

For a function

 f

defined in some open interval containing

 a

(but not necessarily at

 a

), we say

$$\lim_{x \rightarrow a} f(x) = L$$

. If given any number

$$\varepsilon > 0$$

, there is another number

$$\delta > 0$$

, such that

$$0 < |x -$$

 a 

$$| < \delta$$

, guarantees that

$$0 < |f(x) -$$

 L 

$$| < \varepsilon$$

.

QUESTION 22



The squeeze theorem states that if

$$f(x) \leq g(x) \leq h(x)$$

for all numbers in an interval

$$(c, d)$$

except possibly at a point

$$a$$

in this interval, and

$$\lim_{x \rightarrow a} f(x) = \lim_{x \rightarrow a} h(x) = L$$

, then

$$\lim_{x \rightarrow a} g(x) = L$$



$$\lim_{x \rightarrow a^-} g(x) \neq \lim_{x \rightarrow a^+} g(x)$$

$$g(a) = L$$

$$\lim_{x \rightarrow a} g(x)$$

does not exist.

QUESTION 23



Fill in the blank to correctly complete the sentence.

For a function

$$f$$

that is continuous at

$$x = a$$

with

$$\lim_{x \rightarrow a^-} f(x) = 5$$

and

$$\lim_{x \rightarrow a^+} f(x) = 5$$

$$f(a) =$$

5



QUESTION 24



A function

 f

is defined on an open interval containing

$$x = a$$

.

Select the correct answer from the drop-down menu.

The condition

$$\lim_{x \rightarrow a} f(x) = f(a)$$



should be satisfied for the function

 f

to be continuous at

$$x = a$$

.

QUESTION 25



Using the diagram and the squeeze theorem, find the value of L if

$$\lim_{x \rightarrow 1} g(x) = L$$

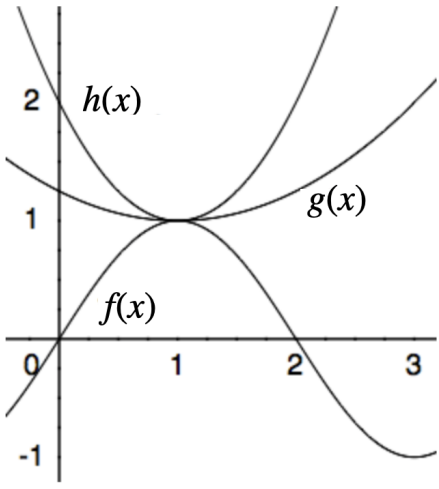
.

Enter your answer in the space provided.

$L =$

1

✓

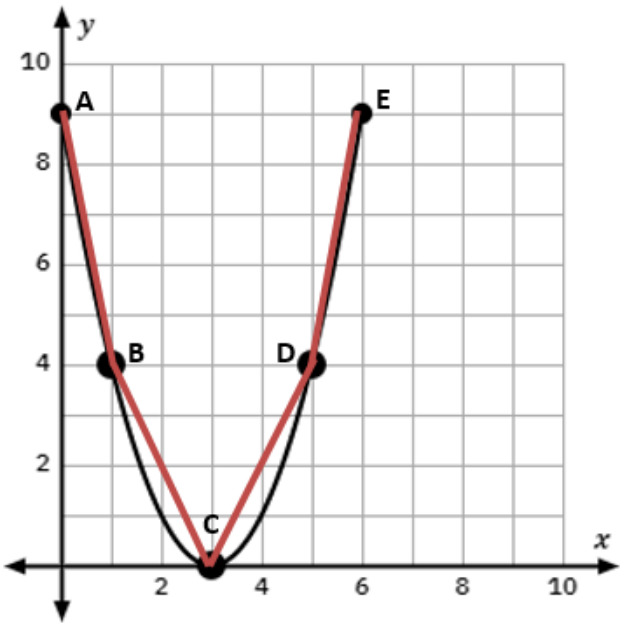


QUESTION 26



Use the table and the 4 segments to estimate the arc length AE.

Segment	Length
AB	$\sqrt{26}$
AC	$\sqrt{90}$
CD	$\sqrt{20}$
DE	$\sqrt{26}$
AE	6
BC	$\sqrt{20}$



The length of arc AE is about

19.1

 units. Round your answer to the nearest tenth.

QUESTION 27



Determine the asymptotes for

$$f(x) = \frac{x^2 - 9}{x - 2}$$

Fill in the spaces provided to complete each statement. Fill in "NA" for *does not exist*.

Vertical asymptote	$x =$ 2 ✓
Horizontal asymptote	$y =$ NA ✓
Slant asymptote	$y =$ x + 2 ✓

QUESTION 28



Use the squeeze theorem to find

$$\lim_{x \rightarrow 0} x^2 e^{\sin x}$$

✓

$$\leq e^{\sin x} \leq$$

✓

$$\lim_{x \rightarrow 0} x^2 e^{\sin x} =$$

0



QUESTION 29



The graph of the function

$$f(x) = \frac{(x^4 - 4)^2 - x^8}{4x^4}$$

shows that

$$\lim_{x \rightarrow \infty} f(x) = -2$$

, which contradicts the fact that when using the calculator, 0 is given for big numbers such that

$$f(5 \times 10^5) = 0$$

. Rewrite the function to avoid the loss-of-significance error, then use the new form to evaluate

$$f(5 \times 10^5)$$

.

☐

$$f(x) = \frac{(x^4 - 4)(x^4 + 4)}{4x^4}$$

;

$$f(5 \times 10^5) = -1$$

☐

$$f(x) = \frac{8x^4 - 16}{4x^4}$$

;

$$f(5 \times 10^5) = 2$$

☐

$$f(x) = \frac{(x^4 - 4 - x^2)^2}{4x^4}$$

;

$$f(5 \times 10^5) = -2.01$$

$$f(x) = \frac{-8x^4 + 16}{4x^4}$$

;

$$f(5 \times 10^5) = -2$$



QUESTION 30



Which of the following satisfies

$$\lim_{x \rightarrow -1} g(x) = \infty$$

?

$$g(x) = \frac{1}{(x+1)^2}$$



☐ $g(x) = \sqrt{x+1}$

☐ $g(x) = \frac{x+1}{x^2-1}$

☐ $g(x) = \frac{x^2-1}{x+1}$