

1. Suppose that 6000 dollars is invested at an annual rate of 4 percent. The future value of the investment after 2 years if the interest is compounded quarterly, is approximately

- A. 6200
- B. 6157
- C. 6947
- D. 6057
- E. 6497

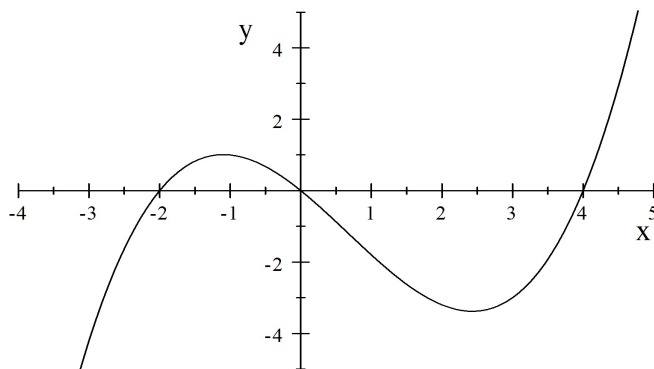
2. A solution to the equation $\left(\frac{1}{8}\right)^{1-x} = 32^{1-x^2}$ is in which of the following intervals?

- A. $-2 < x < -1$
- B. $-1 < x < 0$
- C. $0 < x < 1$
- D. $1 < x < 2$
- E. $2 < x < 3$

3. Find all the vertical asymptotes of $f(x) = \frac{2x^2 - 3x + 1}{x^2 - 5x + 4}$.

- A. $x = 1$
- B. $x = 2$
- C. $x = 4$
- D. $x = 1$ and $x = 4$
- E. $x = 1$, $x = 2$ and $x = 4$

4. The graph of the second derivative, $f''(x)$ for a function f is shown below. Determine where the function f is concave up.



- A. $x < -2$ and $0 < x < 4$
- B. $-2 < x < 0$ and $x > 4$
- C. $x < 1$
- D. $x > 1$
- E. $x < -1$ and $x > 2.5$

5. Consider the function $f(x) = \frac{x^2 - 5}{x + 3}$, for $-2 \leq x \leq \sqrt{5}$. Which of the statements is completely correct?

- A. The absolute minimum of f is -10 .
- B. The absolute minimum is 0 .
- C. The absolute minimum is attained at an endpoint.
- D. The absolute minimum of f is -2 and it is attained at $x = -1$.
- E. There is no absolute minimum for f in the given interval.

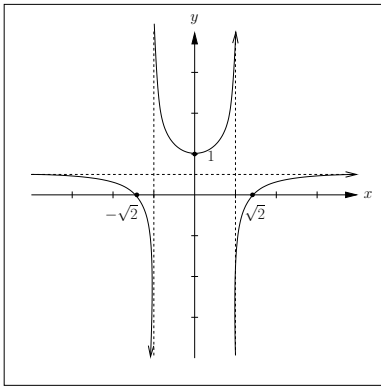
6. What is the absolute minimum value of $f(x) = \frac{x}{x^2 + 9}$ on the interval $-2 \leq x \leq 4$?

- A. $4/25$
- B. $-2/13$
- C. $1/6$
- D. -3
- E. $-1/6$

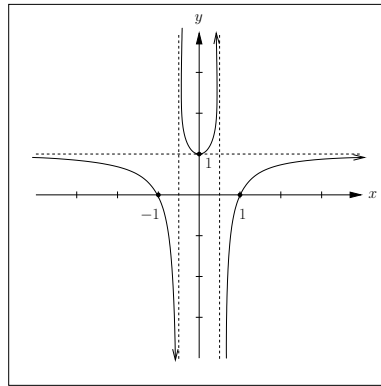
7. If $\log_a(x) = 3$, $\log_a(y) = -1$, and $\log_a(z) = 0$, then calculate $\log_a\left(\frac{x^5}{a^z y^2}\right)$.

- A. 16.
- B. 12.
- C. 17.
- D. 242.
- E. $17 - a$.

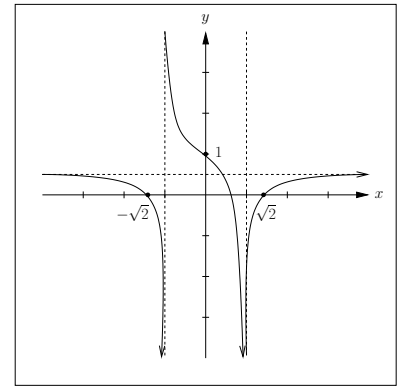
8. Which of the following pictures looks most like the graph of $f(x) = \frac{x^2-2}{2x^2-2}$?



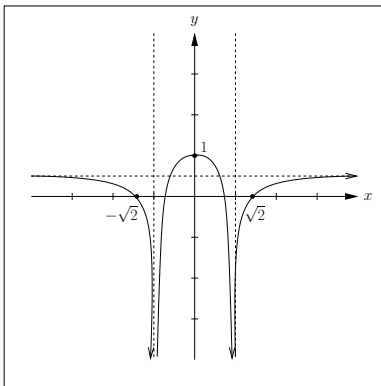
A.



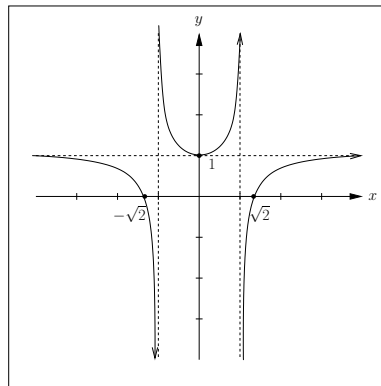
B.



C.



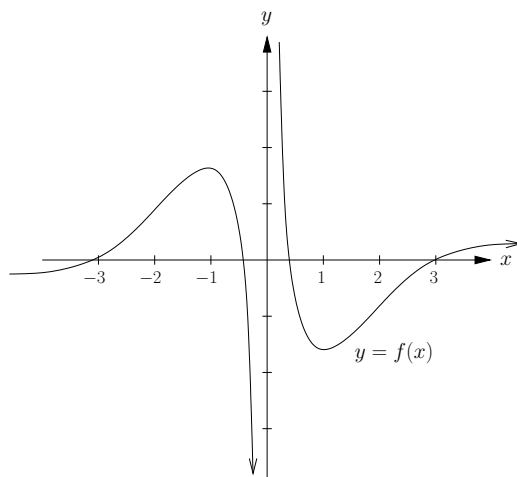
D.



E.

9. Two trolls couple once captured a group of tasty hobbits. The trolls decided to cook the hobbits in a cauldron to make a stew. Suppose that t hours after they started cooking, the temperature of the stew was $S(t) = 14 + 27t + 12t^2 - t^3$ degrees Fahrenheit. To avoid overcooking the hobbits, the trolls decided to start eating as soon as the rate of change of the temperature began to decrease. When did the trolls start eating?
- A. After 1 hour
 - B. After 4 hours
 - C. After 6 hours
 - D. After 9 hours
 - E. After 14 hours
10. Kathy owns an apple orchard. A certain field currently contains 116 trees, with an average yield of 800 lbs. of apples per tree. Kathy estimates that for each additional tree she plants in this field, the average yield will decrease by 5 lbs. of apples per tree. How many additional trees should Kathy plant to maximize her total yield? Round your answer to the nearest tree.
- A. 15
 - B. 22
 - C. 44
 - D. 80
 - E. 160

11. Compute the sign of the first and second derivatives of the function shown.



Sign of f' : $\begin{array}{ccccccc} & + & & - & & - & & + \\ & & & & & & & \\ & -1 & & 0 & & 1 & & \end{array} \rightarrow x$
Sign of f'' : $\begin{array}{ccccccc} & + & & - & & + & & - \\ & & & & & & & \\ & -2 & & 0 & & 2 & & \end{array} \rightarrow x$

A.

Sign of f' : $\begin{array}{ccccccc} & + & & - & & - & & + \\ & & & & & & & \\ & -1 & & 0 & & 1 & & \end{array} \rightarrow x$
Sign of f'' : $\begin{array}{ccccccc} & & & - & & & & + \\ & & & & & & & \\ & & & 0 & & & & \end{array} \rightarrow x$

B.

Sign of f' : $\begin{array}{ccccccc} & + & & - & & - & & + \\ & & & & & & & \\ & -1 & & 0 & & 1 & & \end{array} \rightarrow x$
Sign of f'' : $\begin{array}{ccccccc} & + & & - & & + & & - \\ & & & & & & & \\ & -1 & & 0 & & 1 & & \end{array} \rightarrow x$

C.

Sign of f' : $\begin{array}{ccccccc} & + & & - & & + & & - \\ & & & & & & & \\ & -1 & & 0 & & 1 & & \end{array} \rightarrow x$
Sign of f'' : $\begin{array}{ccccccc} & + & & - & & + & & - \\ & & & & & & & \\ & -2 & & 0 & & 2 & & \end{array} \rightarrow x$

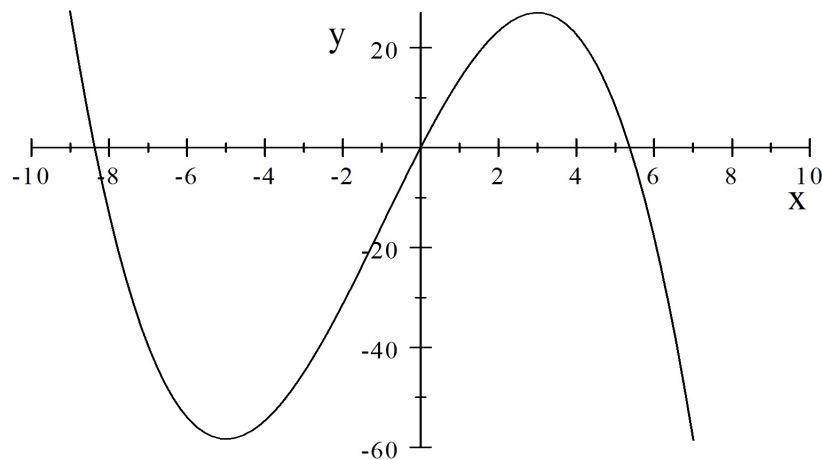
D.

Sign of f' : $\begin{array}{ccccccc} & + & & - & & + & & - \\ & & & & & & & \\ & -1 & & 0 & & 1 & & \end{array} \rightarrow x$
Sign of f'' : $\begin{array}{ccccccc} & & & - & & & & + \\ & & & & & & & \\ & & & 0 & & & & \end{array} \rightarrow x$

E.

12. Robinson Helicopter Company is the largest manufacturer of civil helicopters in the United States. They currently sell 350 helicopters per year and sell them for \$430 thousand apiece. Market research suggests that for each \$2 thousand reduction in price, they will sell one more helicopter per year. If it costs them \$300 thousand to make a helicopter, what price should they sell them for to maximize profits?
- A. \$15 thousand
 - B. \$452.5 thousand
 - C. \$500 thousand
 - D. \$565 thousand
 - E. \$715 thousand

13. The graph of the first derivative, $f'(x)$ is shown below for some function f . Find all values of x for which $f(x)$ has an inflection point.



- A. $x = -8.5, x = 0, x = 5.5$
- B. $x = -2$
- C. $x = -5, x = 3$
- D. $x = -8.5, x = 5.5$
- E. $x = 0$

14. Christopher wants to construct an open cylinder to hold his basketball collection. The material for the bottom costs \$3 per square foot, and the material for the sides costs \$2 per square foot. If Christopher has \$40 to spend on this project, what should the radius be to maximize the volume of the cylinder? Round your answer to two decimal places.
- A. 3.33 feet
 - B. 2.06 feet
 - C. 1.46 feet
 - D. 1.19 feet
 - E. 0.84 feet
15. A group of Marines are in an amphibious vehicle in the ocean 2 miles off a straight coastal beach of Guadalcanal. They are trying to get to an enemy position that is 3 miles down the straight beach from the point on the beach that is closest to their current position in the ocean. If their vehicle can travel 10 mph on water and 20 mph on land, find the shortest time for them to reach the enemys position.
- A. 69 minutes
 - B. 30 minutes
 - C. 21 minutes
 - D. 19 minutes
 - E. 15 minutes