1. What is the domain of the function $f(t) = \dfrac{\sqrt{t^2 - 1}}{t - 3}$?

2.
Find the indicated composite function: $f(x + 3)$, where $f(x) = x^3 + 2$.

A) $x^3 + 5$ B) $x^3 + 6$ C) $(x+3)^3 + 2$ D) $x^3 + x + 5$

3.
An efficiency study of the morning shift at a certain factory indicates that an average worker who arrives on the job at 8:00 A.M. will have assembled $f(x) = -x^3 + 5x^2 + 16x$ transistor radios x hours later. How many radios will such a worker assemble between 10:00 and 11:00 A.M.?

A) 20 B) 22 C) 15 D) 18

4. Find $f(2)$ where $f(x) = \begin{cases} x^2 - 1 & \text{if } x < 1 \\ 3 & \text{if } x = 1 \\ 2 - 5x & \text{if } x > 1 \end{cases}$

5.
True or False: The domain of $f(x) = \dfrac{x+1}{x^2 - 1}$ is all x except 1.

A) True
B) False

6. A manufacturer of self-baiting mousetraps is currently selling 1,500 traps a month to retailers at a price of $1 per trap. She estimates that for each 5 cent increase in price, she will sell 25 fewer traps per month. Her costs consist of a fixed overhead of $180 a month and 30 cents per trap for labor and materials. Find the dollar profit $P(x)$ as a function of the price x. Estimate the value of x where the maximum occurs from the graph.

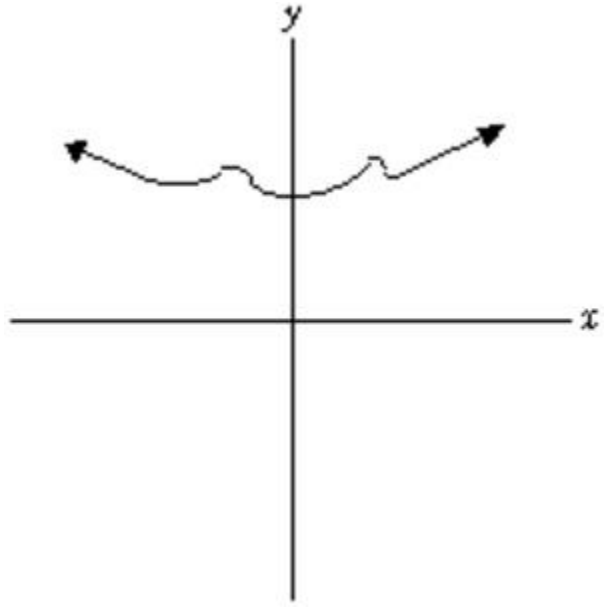
7. An apartment complex in a small college town has 120 units total. If they charge $1200 per month, they can rent every apartment, but each $50 increase in rent will result in 3 vacant apartments. Find the price they should charge to maximize their revenue. (Hint: Write a function describing revenue in terms of monthly rent, then find the vertex).

8. The cost of renting a backhoe at one distributor is $320, plus $35 per day. Write a linear function $C(x)$ that describes the cost of renting the backhoe for x days, then use your function to find how much it would cost to rent it for 20 days.

A) $C(x) = 320x + 35$; $6,435
C) $C(x) = 320 + 35x$; $1,020
B) $C(x) = 20(320 + 35x)$; $20,400
D) $C(x) = 35x + 300$; $1000

9.

True or False: The first derivative of a function is graphed below. The function has at least one relative extrema.



A) True
B) False

10. Find the limit: $\lim_{x \to 4} \dfrac{\sqrt{x} - 2}{x - 4}$

A) Does not exist B) 4 C) $-\frac{1}{4}$ D) $\frac{1}{4}$

11. Find all the values of x for which the function is not continuous. $f(x) = \begin{cases} x^2 + 4 & \text{if } x \le 5 \\ 4 & \text{if } x > 5 \end{cases}$

12. Find the equation of the tangent line to the curve $f(x) = \dfrac{4}{x} - x$ at the point where $x = 1$

13.

The equation of the line tangent to the graph of $f(x) = 3\sqrt{x}$ at $x = 1$ is

A) $y = \frac{1}{2}x - \frac{1}{2}$ B) $y = \frac{1}{2}x + \frac{1}{2}$ C) $y = \frac{3}{2}x + \frac{3}{2}$ D) $y = \frac{3}{2}x - 1$

14. A manufacturer can produce radios for $10 apiece. It is estimated that if the radios are sold for x dollars apiece, consumers will buy $100 - x$ of them each month. Use calculus to determine the price in dollars at which profit will be greatest.

15. For $f(x) = 18 - x^2$, find the slope of the secant line connecting the points whose x-coordinates are $x = -5$ and $x = -4.9$. Then use calculus to find the slope of the line that is tangent to the graph of f at $x = 5$.

16.

True or False: Differentiating $f(x) = \frac{1}{3}x^7 - 2x^5 + 9x - 8$ gives $\frac{7x^6}{3} - 10x^4 + 9$.

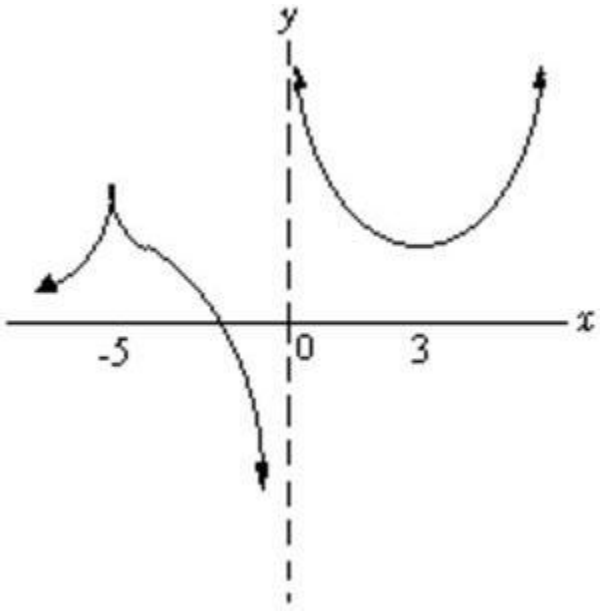
A) True
B) False

17.

An appliance store estimates that they can sell $R(x)$ refrigerators in a month according to the formula $R(x) = -0.01x^3 + x^2 - 3x + 200$ where x is the number of television ads they run per day. Find $R'(4)$ and interpret what it tells us about sales.

A) $R'(4) = 203.36$; they'll sell about 203 refrigerators if they run 4 ads per day.
B) $R'(4) = 4.52$; they'll sell about 5 refrigerators if they run 4 ads per day.
C) $R'(4) = 4.52$; sales will be increasing at about 5 refrigerators per month per ad when they're running 4 ads.
D) $R'(4) = 203.36$; the cost of refrigerators will be rising by $203.36 if they're selling 4 per day.

18.
Find all intervals where the derivative of the function shown below is negative.



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19.
A small manufacturing company estimates that the total cost in dollars of producing x radios per day is given by the formula $C = 0.1x^2 + 20x + 500$. Find the number of units that will minimize the average cost.
A) 100 B) 147 C) 36 D) 71

20.
A 5-year projection of population trends suggests that t years from now, the population of a certain community will be $P(t) = -t^3 + 12t^2 + 144t + 55$ thousand.

1) At what time during the 5-year period will the population be growing most rapidly?

2) At what time during the 5-year period will the population be growing least rapidly?

3) At what time is the rate of population growth changing most rapidly?

A) t = 4 years; t = 0 years; t = 0 years
B) t = 0 years; t = 0 years; t = 4 years
C) t = 4 years; t = 3 year; t = 5 years
D) t = 4 years; t = 0 years; t = 4 years

21.

If the demand for a commodity is $D(p) = 146 - 2p - 4p^2$ and the average cost is $A(x) = 1 + \frac{1}{x}$, find the maximum profit