1. Find the equation for the horizontal asymptote of $G(x)$ as $x \to \infty$

$$G(x) = \left(\frac{x - 3x^2}{2x^2 - 13} \right)$$

A. $y = 0$
B. $y = -1$
C. $y = \frac{1}{2}$
D. $y = -3$
E. $y = -\frac{3}{2}$

2. John has 480 feet of fence to enclose a rectangular field. He will use the barn as one side of the rectangle and fence in the other three sides. Find the dimensions of the field that gives the maximum area.

A. 120 ft. by 120 ft.
B. 120 ft. by 240 ft.
C. 240 ft. by 240 ft.
D. 80 ft. by 320 ft.
E. 160 ft. by 160 ft.

3. It has been estimated that x months after the beginning of a study, the number of insects in certain region is given by

$$N(x) = \frac{1500x}{x^2 + 45}.$$

After how many months is the number of insects largest?

A. 6.7
B. 3
C. 8.3
D. 5
E. 1

4. t days after a spill, the concentration of a pollutant in the Wabash river is $ce^{-\frac{2}{3}t}$ grams per liter. After 1 day, the concentration was 3 grams per liter. What will be the concentration after 4 days? (Round your answer to 2 decimal places.)

A. 0.41 grams per liter
B. 1.54 grams per liter
C. 0.11 grams per liter
D. 0.21 grams per liter
E. 0.79 grams per liter

5. Find the interval(s) where the function $f(x) = x + \frac{4}{x}$ is decreasing.

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

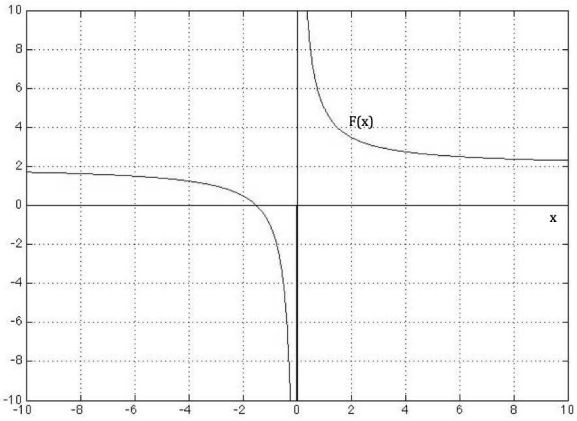
6. The concentration of a drug in a patient's kidneys at time t (in seconds) is C grams per cubic centimeter (g/cm^3), where

$$C(t) = 0.35(1.5 - 0.48e^{-0.03t})$$

How long will it take for the drug concentration to reach 0.5 g/cm^3.

A. 182.4 seconds
B. 38.7 seconds
C. 27.6 seconds
D. 63.5 seconds
E. 98.5 seconds

7. Given the graph of a function, $F(x)$, below, which of the following choices of functions best matches the properties of $F(x)$.



A. $F(x) = \left(\dfrac{3-2x}{x}\right)$
B. $F(x) = \left(\dfrac{2x-3}{x-2}\right)$
C. $F(x) = \left(\dfrac{2x+3}{x^2}\right)$
D. $F(x) = \left(\dfrac{6x-3}{x}\right)$
E. $F(x) = \left(\dfrac{2x+3}{x}\right)$

8. John wants to make a box with volume 500 in^3 for his coin collections. The box has a square base and four sides, but no top cover. Assume the length of its base is x, and the height of the box is h. Find the height h that will minimize the surface area of the box.

   A. $h = 2.5$ inches
   B. $h = 4$ inches
   C. $h = 5$ inches
   D. $h = 10$ inches
   E. $h = 20$ inches

9. Simplify the following expression:

$$log_2\left(\frac{(x+1)^2}{\sqrt{x^2+1}}\right) + \log_2\left(\frac{1}{2(x+1)}\right)$$

   A. $\log_2(x+1) - \frac{1}{2}\log_2(x^2+1) - 1$
   B. $\log_2(x+1) - \frac{1}{2}\log_2(x^2+1) + 1$
   C. $\frac{1}{2}\log_2(x^2+1)$
   D. $\log_2(x+1) + \frac{1}{2}\log_2(x^2+1) + 1$
   E. $3\log_2(x+1) - \frac{1}{2}\log_2(x^2+1) - 1$

10. Find the absolute maximum and absolute minimum of the function below, on the specified interval.

$$f(x) = \frac{x}{1+x^2}; -3 \leq x \leq 0$$

A. abs max $= 0$; abs min $= -\frac{1}{2}$

B. abs max $= 1/2$; abs min $= -\frac{3}{10}$

C. abs max $= 1/2$; abs min $= 0$

D. abs max $= 1/2$; abs min $= -\frac{1}{2}$

E. abs max $= 0$; abs min $= -\frac{3}{10}$

11. Harry Potter is planning to invest \$7,000 (that he earned by killing Voldemort) for 6 years at an annual interest rate of 10%. How much more will his investment be worth at the end of the 6 years if the interest is compounded continuously, rather than quarterly? (Round your answer to the nearest dollar.)

A. \$2346

B. \$57

C. \$260

D. \$94

E. \$354

12. Find the interval(s) where the graph of the function g is concave downward and find the value(s) of t where inflection points occur.

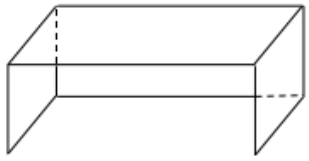
$$g(t) = \left(\frac{t+2}{t+3}\right)^2$$

A. $t < -3$ and $t > -\frac{3}{2}$; inflection points when $t = -3$ and $t = -\frac{3}{2}$.
B. $-3 < t < -\frac{3}{2}$; inflection point when $t = -\frac{3}{2}$.
C. $t < -3$ and $t > -\frac{3}{2}$; no inflection points.
D. $t > -\frac{3}{2}$; inflection point when $t = -\frac{3}{2}$.
E. $-3 < t < -\frac{3}{2}$; inflection point when $t = -3$.

13. Katrina the bear finds that when she sends out 52 of her cubs to gather honey, each cub will gather 44 ounces of honey per day. Katrina estimates that for each additional 3 cubs she sends out to gather honey, the amount of honey gathered by each cub will decrease by 6 ounces, while for every 3 fewer cubs she sends out, the amount of honey gathered by each cub will increase by 6 ounces. Find the maximum number of ounces of honey per day that can be gathered by Katrina's cubs.

A. 2860
B. 2738
C. 2664
D. 2450
E. 2288

14. A rectangular shelter for a bus stop is being constructed with a rectangular back, a rectangular top and square sides, as shown below. (Note that there is no front or bottom on the shelter.) If there are 96 square feet of lumber available to build the shelter, find the maximum volume the shelter can have, to the nearest cubic foot.



A. 64
B. 362
C. 79
D. 128
E. 256

15. Emma is preparing a rectangular poster for the upcoming concert. She can only afford the price for a total area of 1800 in^2 for the poster. The poster consists of a smaller rectangular printed area and its surrounding margins. The widths of the margins are 10 in for top and bottom, and 5 in for two sides. What is the maximum printed area possible if Emma chooses the dimensions of the poster wisely.

A. 500 in^2
B. 600 in^2
C. 800 in^2
D. 1000 in^2
E. 1250 in^2