1. Find the derivative of \( y \) with respect to \( x \).

\[
y = -\cos^{-1}\left(\frac{1}{x^3}\right)
\]

- A. \( \frac{-3x^3}{\sqrt{1-x^6}} \)
- B. \( \frac{-3}{1+x^6} \)
- C. \( \frac{-3}{x\sqrt{x^6-1}} \)
- D. \( \frac{-3}{x\sqrt{1-x^6}} \)

ID: 3.10-10

2. Given the function \( f \), find the slope of the line tangent to the graph of \( f^{-1} \) at the specified point on the graph of \( f^{-1} \).

\( f(x) = (x + 2)^2 \) for \( x \geq -2 \); (4,0)

The slope of the line tangent to the graph of \( f^{-1} \) at (4,0) is \( \text{___________} \). (Simplify your answer.)

ID: 3.10.55

3. A piece of land is shaped like a right triangle. Two people start at the right angle of the triangle at the same time, and walk at the same speed along different legs of the triangle. If the area formed by the positions of the two people and their starting point (the right angle) is changing at 5 \( \text{m}^2/\text{s} \), then how fast are the people moving when they are 3 m from the right angle? (Round your answer to two decimal places.)

- A. 1.8 m/s
- B. 0.833 m/s
- C. 3.333 m/s
- D. 1.667 m/s

ID: 3.11-4
4. Electrical systems are governed by Ohm's law, which states that \( V = IR \), where \( V \) = voltage, \( I \) = current, and \( R \) = resistance. If the current in an electrical system is decreasing at a rate of 6 A/sec while the voltage remains constant at 14 V, at what rate is the resistance increasing (in \( \Omega/sec \)) when the current is 32 A? (Do not round your answer.)

- A. \( \frac{21}{256} \) \( \Omega/sec \)
- B. \( \frac{63}{4} \) \( \Omega/sec \)
- C. \( \frac{8}{21} \) \( \Omega/sec \)
- D. \( \frac{21}{8} \) \( \Omega/sec \)

ID: 3.11-8

5. Find the absolute extreme values of the function on the interval.

\[ f(x) = x^{4/3}, \quad -1 \leq x \leq 8 \]

- A. absolute maximum is 64 at \( x = 8 \); absolute minimum is 0 at \( x = 1 \)
- B. absolute maximum is 16 at \( x = 8 \); absolute minimum is 0 at \( x = 0 \)
- C. absolute maximum is 16 at \( x = 8 \); absolute minimum is 1 at \( x = -1 \)
- D. absolute maximum is 16 at \( x = 8 \); absolute minimum does not exist

ID: 4.1-17

6. Determine whether Rolle's theorem applies to the function shown below on the given interval. If so, find the point(s) that are guaranteed to exist by Rolle's theorem.

\[ f(x) = -\cos 5x; \quad \left[ \frac{\pi}{10}, \frac{3\pi}{10} \right] \]

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- A. Rolle's Theorem applies and the point(s) guaranteed to exist is/are \( x = \) ____________.
  (Type an exact answer, using \( \pi \) as needed. Use a comma to separate answers as needed.)

- B. Rolle's Theorem does not apply.

ID: 4.2.13
7. Find the value or values of \( c \) that satisfy the equation \( \frac{f(b) - f(a)}{b - a} = f'(c) \) in the conclusion of the Mean Value Theorem for the function and interval.

\( f(x) = x^2 + 4x + 3, \ [ -3, 2] \)

- **A.** \( 0, -\frac{1}{2} \)
- **B.** \( -\frac{1}{2} \)
- **C.** \( -\frac{1}{2}, \frac{1}{2} \)
- **D.** \( -3, 2 \)

ID: 4.2-1

8. Find the intervals on which \( f \) is increasing and decreasing.

\( f(x) = -12x^5 + 105x^4 - 200x^3 \)

Select the correct choice below and fill in any answer boxes within your choice.

- **A.** The function is increasing on \( \) and decreasing on \( \).
  (Simplify your answers. Type your answers in interval notation. Use a comma to separate answers as needed.)

- **B.** The function is increasing on \( \). The function is never decreasing.
  (Simplify your answer. Type your answer in interval notation. Use a comma to separate answers as needed.)

- **C.** The function is decreasing on \( \). The function is never increasing.
  (Simplify your answer, Type your answer in interval notation. Use a comma to separate answers as needed.)

- **D.** The function is never increasing or decreasing.

ID: 4.3.39
9. Determine the intervals on which the following function is concave up or concave down. Identify any inflection points.

\[ f(x) = -e^{-x^2/50} \]

Determine the intervals on which the function is concave up or concave down. Select the correct choice below and, if necessary, fill in the answer box(es) within your choice.

- A. The function is concave up on \[ \text{______________} \] and concave down on \[ \text{______________}. \] (Simplify your answers. Type your answers in interval notation. Use a comma to separate answers as needed.)

- B. The function is concave up on \[ \text{______________}. \] The function is never concave down. (Simplify your answer. Type your answer in interval notation.)

- C. The function is concave down on \[ \text{______________}. \] The function is never concave up. (Simplify your answer. Type your answer in interval notation.)

- D. The function is never concave up nor concave down.

Locate any inflection points of \( f \). Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- A. There are inflection points at \( x = \text{______________}. \) (Use a comma to separate answers as needed.)

- B. There are no inflection points.

ID: 4.3.71
10. Use the graph of $f'$ and $f''$ to find the critical points and inflection points of $f$, the intervals on which $f$ is increasing and decreasing, and the intervals of concavity. Then, graph $f$ assuming $f(0) = 0$.

Find the critical points.

The critical points are $x =$ ___________. (Use a comma to separate answers as needed.)

Find the inflection points.

The inflection points occur at $x =$ ___________. (Use a comma to separate answers as needed.)

Find the intervals on which $f$ is increasing and decreasing.

$f$ is increasing on ___________.
(Type your answer in interval notation. Use a comma to separate answers as needed.)

$f$ is decreasing on ___________.
(Type your answer in interval notation. Use a comma to separate answers as needed.)

Find the intervals of concavity.

$f$ is concave down on ___________.
(Type your answer in interval notation. Use a comma to separate answers as needed.)

$f$ is concave up on ___________.
(Type your answer in interval notation. Use a comma to separate answers as needed.)

Graph $f$ assuming $f(0) = 0$. Choose the correct graph below.

○ A.  

○ B.  

○ C.  

○ D.  

ID: 4.4.47
11. What two nonnegative real numbers with a sum of 52 have the largest possible product?

Let \( x \) be one of the numbers and let \( P \) be the product of the two numbers. Write the objective function in terms of \( x \).

\[ P = \underline{\quad} \]

(Type an expression.)

The interval of interest of the objective function is \( \underline{\quad} \).

(Simplify your answer. Type your answer in interval notation.)

The numbers that have a sum of 52 and have the largest possible product are \( \underline{\quad} \).

(Use a comma to separate answers as needed.)

ID: 4.5.7-Setup & Solve

12. A company is constructing an open-top, square-based, rectangular metal tank that will have a volume of 62.5 ft\(^3\). What dimensions yield the minimum surface area? Round to the nearest tenth, if necessary.

- **A.** 4.0 ft \( \times \) 4.0 ft \( \times \) 4.0 ft
- **B.** 5.0 ft \( \times \) 5.0 ft \( \times \) 2.5 ft
- **C.** 11.2 ft \( \times \) 11.2 ft \( \times \) 0.5 ft
- **D.** 5.7 ft \( \times \) 5.7 ft \( \times \) 1.9 ft

ID: 4.5-2
1. \[ \frac{-3}{x\sqrt{x^6 - 1}} \]

2. \[ \frac{1}{4} \]

3. D. 1,667 m/s

4. A. \[ \frac{21}{256} \] Ω/sec

5. B. absolute maximum is 16 at \( x = 8 \); absolute minimum is 0 at \( x = 0 \)

6. A. Rolle's Theorem applies and the point(s) guaranteed to exist is/are \( x = \frac{\pi}{5} \).
   (Type an exact answer, using \( \pi \) as needed. Use a comma to separate answers as needed.)

7. B. \[ -\frac{1}{2} \]

8. A. The function is increasing on \( (2,5) \) and decreasing on \( (-\infty,2),(5,\infty) \).
   (Simplify your answers. Type your answers in interval notation. Use a comma to separate answers as needed.)

9. A. The function is concave up on \( (-5,5) \) and concave down on \( (-\infty,-5),(5,\infty) \).
   (Simplify your answers. Type your answers in interval notation. Use a comma to separate answers as needed.)
   A. There are inflection points at \( x = -5,5 \). (Use a comma to separate answers as needed.)

10. 2,6
6
4
(0,2),(6,8)
(2,6)
(0,4)
(4,8)
11. x(52 – x)
   [0,52]
   26,26

12. B. 5.0 ft × 5.0 ft × 2.5 ft