



Topic: Maximum and Minimum Values 1

Worksheet

Question 1: Locate the absolute maximum of $f(x) = x^2 - 9$ on the interval $[-3, 3]$.

- A. $f(-3) = f(3) = -9$
- B. $f(0) = -9$
- C. $f(0) = f(3) = f(-3) = 3$
- D. $f(-3) = f(3) = 0$

Question 2: Locate the absolute minimum of $f(x) = x^2 - 9$ on the interval $[-\infty, \infty]$.

- A. $f(-3) = f(3) = -9$
- B. $f(0) = -9$
- C. $f(0) = f(3) = f(-3) = 3$
- D. $f(-3) = f(3) = 0$

Question 3: Find the absolute extrema of $f(x) = \frac{1}{x}$ on the interval $[1, 3]$.

- A. Max $f(-3) = 3$ & Min $f(0) = 1$
- B. Max $f(3) = \frac{1}{3}$ & Min $f(0) = 1$
- C. Max $f\left(\frac{1}{3}\right) = 3$ & Min $f(1) = 1$
- D. Max $f(1) = 1$ & Min $f(3) = \frac{1}{3}$



Topic: Maximum and Minimum Values 2

Worksheet

Question 1: Find the critical numbers of $f(x) = 2x^3 - 3x^2 - 12x + 5$.

- A. $x = 0$ & $x = 2$
- B. $x = -2$ & $x = 2$
- C. $x = -1$ & $x = 2$
- D. $x = 1$ & $x = -2$

Question 2: Find the critical numbers of $f(x) = (3x + 1)^{\frac{2}{3}}$.

- A. $x = -\frac{1}{3}$
- B. $x = 0$
- C. $x = \frac{1}{3}$
- D. $x = 1$

Question 3: What are the local extrema of $f(x) = x^3$.

- A. $x = 0$
- B. $x = 1$
- C. $x = 3$
- D. There is no local extremum.



Topic: Maximum and Minimum Values 3

Worksheet

Question 1: What are the local extrema of $f(x) = x^{\frac{1}{3}}$.

- A. $x = 0$
- B. $x = 1$
- C. $x = 3$
- D. There is no local extremum.

Question 2: Find all the critical numbers of $f(x) = \frac{2x^2}{x+2}$.

- A. $x = 0, x = -2$ & $x = -4$
- B. $x = 0$ & $x = -2$
- C. $x = -2$ & $x = -4$
- D. $x = 0$ & $x = -4$

Question 3: Find the absolute extrema of $f(x) = 2x^3 - 3x^2 - 12x + 5$ on the interval $[-2, 4]$.

- A. Absolute min $f(-2) = 1$ & absolute max $f(-1) = 12$
- B. Absolute min $f(-2) = 1$ & absolute max $f(2) = -15$
- C. Absolute min $f(2) = -15$ & absolute max $f(4) = 37$
- D. Absolute min $f(-1) = 12$ & absolute max $f(4) = 37$

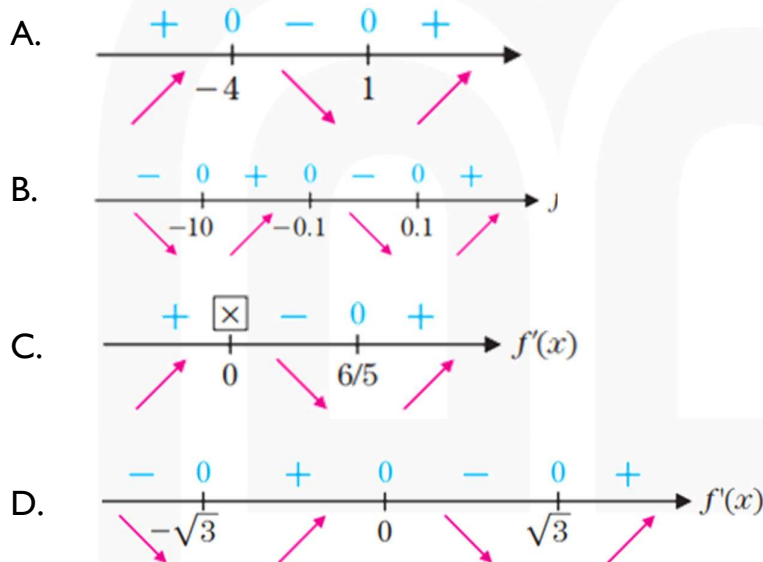


Topic: Increasing and Decreasing Functions 1

Worksheet

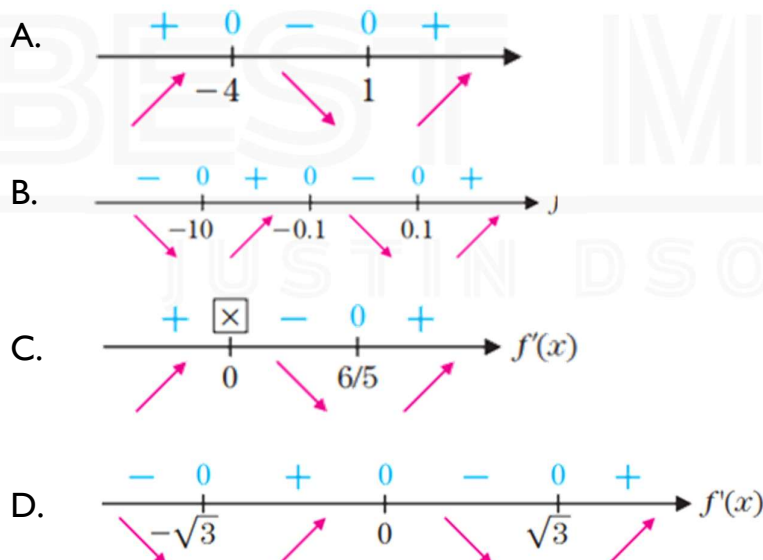
Question 1: Draw the sketch showing all the local extrema

$$f(x) = 2x^3 + 9x^2 - 14x - 10.$$



Question 2: Draw the sketch showing all the local extrema

$$f(x) = x^4 - 6x^2 + 1.$$





Practice

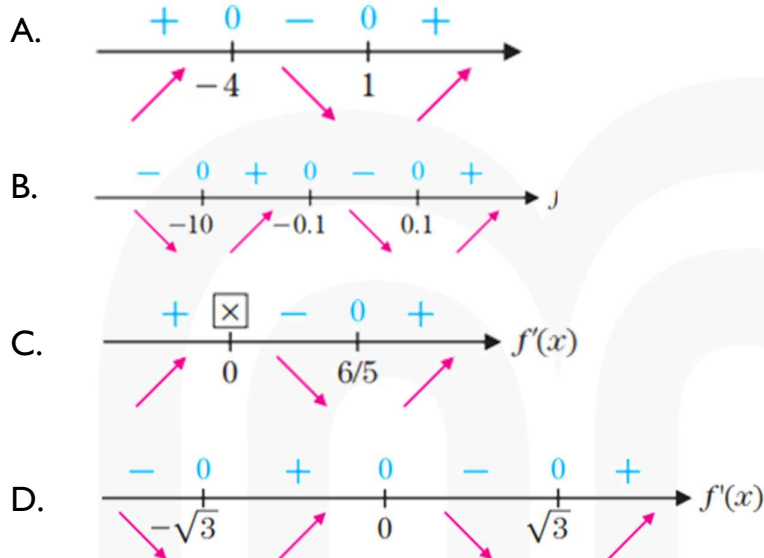
Makes

Perfect



Question 3: Draw the sketch showing all the local extrema

$$f(x) = 3x^4 + 40x^3 - 0.06x^2 - 1.2x.$$



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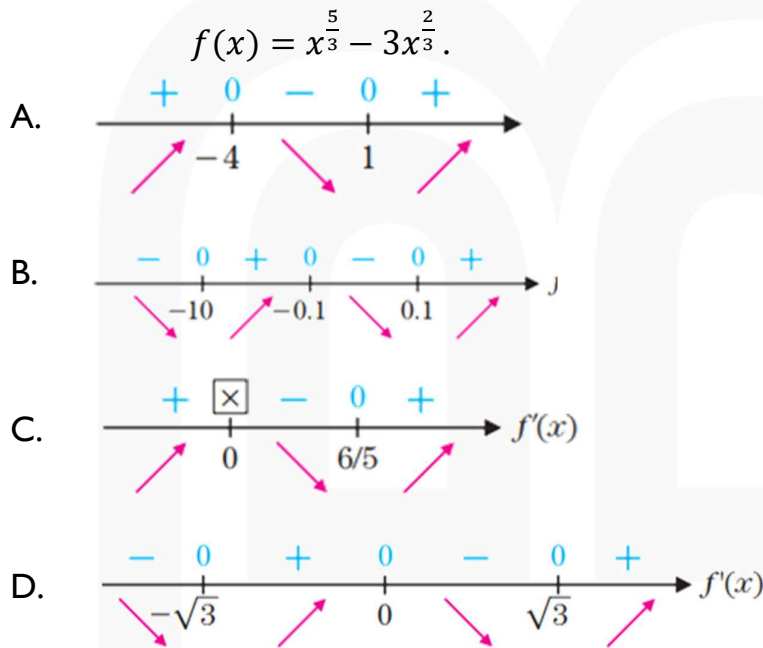
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Topic: Increasing and Decreasing Functions 2

Worksheet

Question 1: Draw the sketch showing all the local extrema



Question 2: Find all the critical numbers of

$$f(x) = x^4 + 4x^3 - 5x^2 - 31x + 29.$$

- A. $x = 0, x = -2$ & $x = -4$
- B. $x = 0$ & $x = -2$
- C. $x = -2$ & $x = -4$
- D. $x = 0$ & $x = -4$



Practice

Makes

Perfect



Question 3: Locate the points of local maximum and minimum for

$$f(x) = 2x^3 + 9x^2 - 24x - 10.$$

- A. Local max at $x = 1$ & Local min at $x = 5$.
- B. Local max at $x = 1$ & Local min at $x = -4$.
- C. Local max at $x = 7$ & Local min at $x = 1$.
- D. Local max at $x = -4$ & Local min at $x = 1$.

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Topic: Concavity and the Second Derivative Test 1

Worksheet

Question 1: Draw the sketch of concavity

$$f(x) = x^4 - 6x^2 + 1.$$

- A.
- B.
- C.
- D.

Question 2: Draw the sketch showing all the local extrema

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

- A.
- B.
- C.
- D.



Practice

Makes

Perfect



Question 3: Find the point of inflection

$$f(x) = 2x^3 + 9x^2 - 24x - 10.$$

- A. 0.5
- B. -1
- C. -1.5
- D. 2



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Topic: Concavity and the Second Derivative Test 2

Worksheet

Question 1: Find the second derivative of

$$f(x) = x^4 - 8x^2 + 10.$$

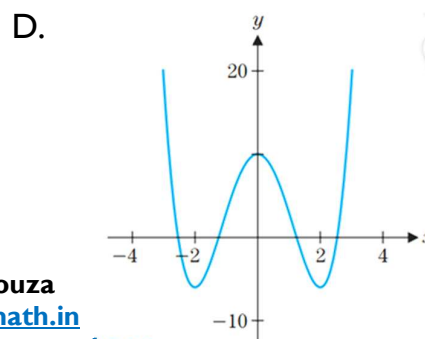
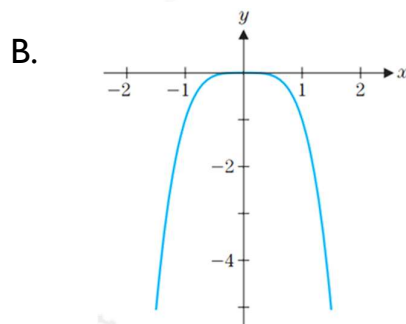
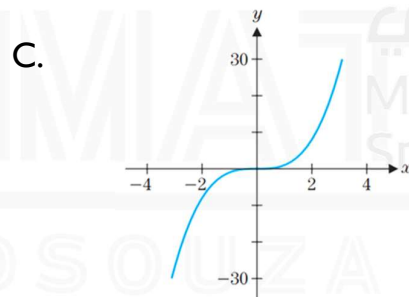
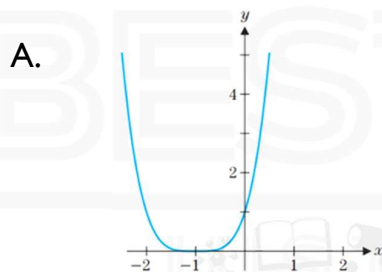
- A. $f''(x) = 12x^2 - 16$
- B. $f''(x) = 4x^3 - 16x$
- C. $f''(x) = 12x^2 - 16x$
- D. $f''(x) = 4x^2 - 8x + 1$

Question 2: Find the point of inflection

$$f(x) = (x + 2)^{\frac{1}{5}} + 4.$$

- A. 0.5
- B. -1
- C. 1.5
- D. -2

Question 3: Graph $f(x) = -x^4$



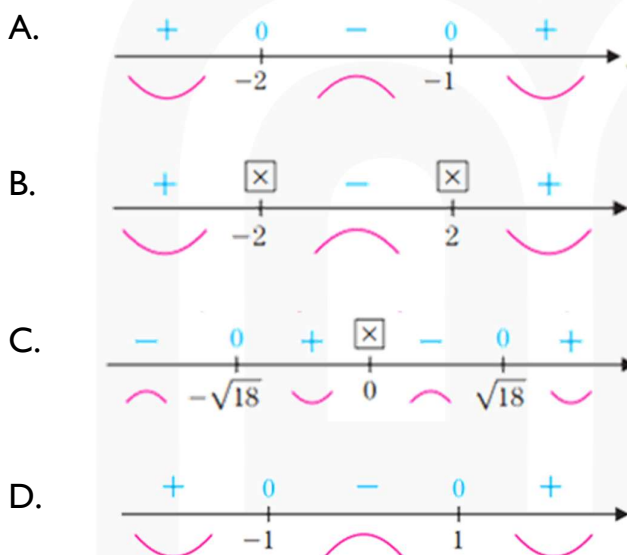


Topic: Overview of Curve Sketching 1

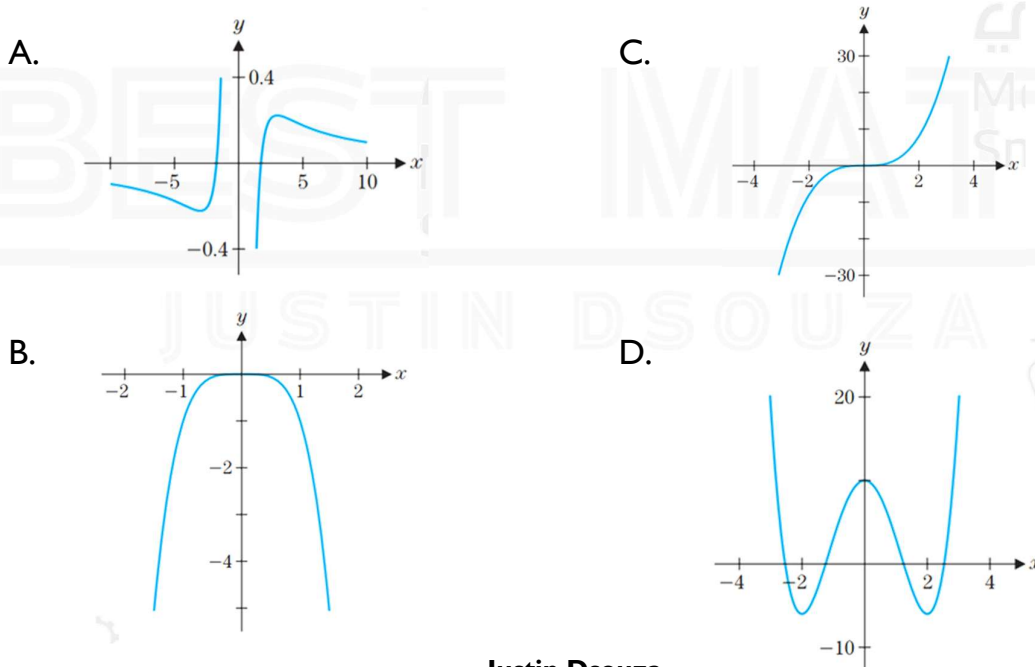
Worksheet

Question 1: Draw the sketch of concavity

$$f(x) = x^4 + 6x^3 + 12x^2 + 8x + 1.$$



Question 2: Draw the graph of $f(x) = \frac{x^2-3}{x^3}$.





Practice

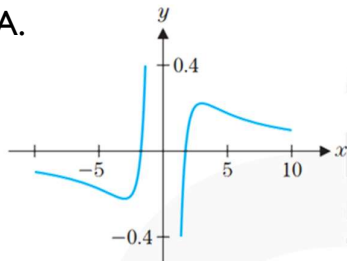
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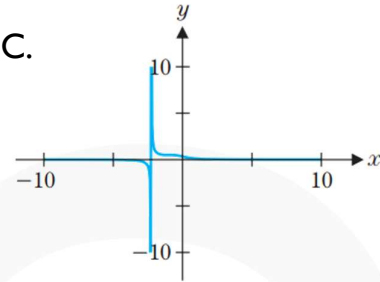


Question 3: Draw the graph of $f(x) = \frac{x^2}{x^2-4}$.

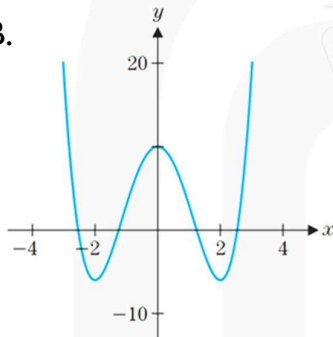
A.



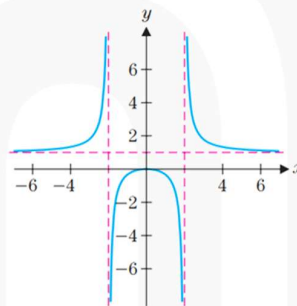
C.



B.



D.



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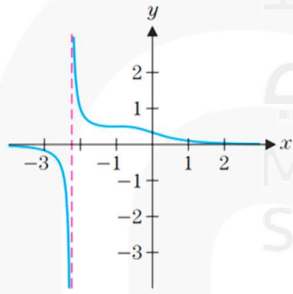


Topic: Overview of Curve Sketching 2

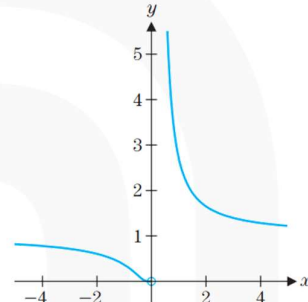
Worksheet

Question 1: Draw the graph of $f(x) = \frac{1}{x^3 + 3x^2 + 3x + 3}$.

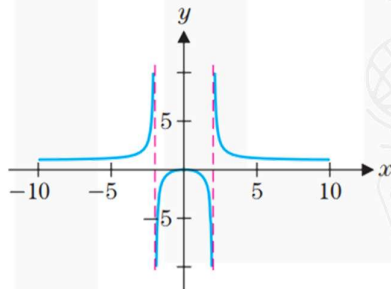
A.



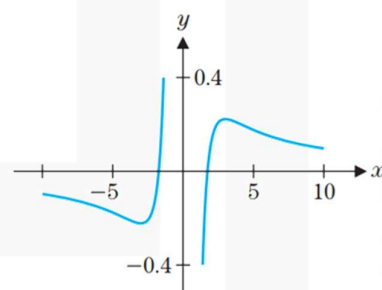
C.



B.

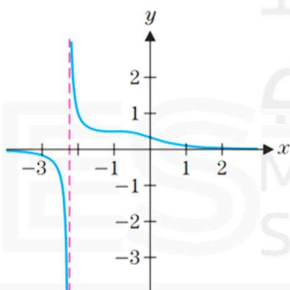


D.

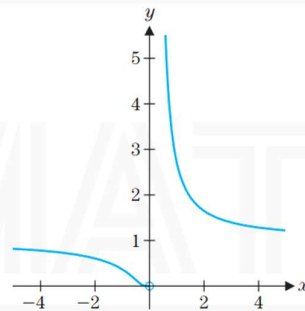


Question 2: Draw the graph of $f(x) = e^{\frac{1}{x}}$.

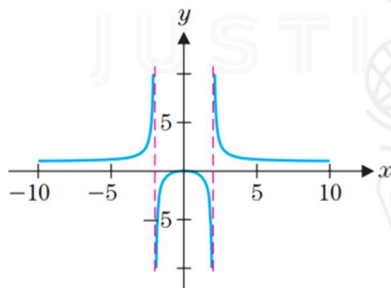
A.



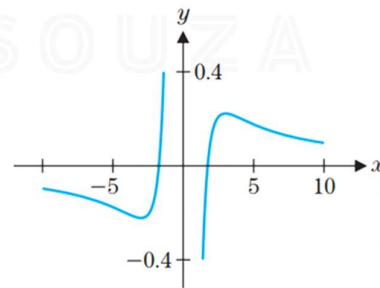
C.



B.



D.



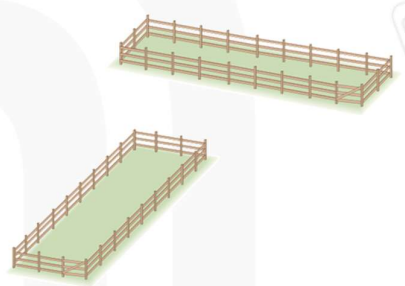


Topic: Optimization 1

Worksheet

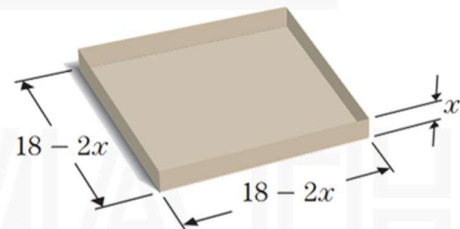
Question 1: There is 40 feet (linear) of fencing with which to enclose a rectangular space for a garden. Find the largest area that can be enclosed with this much fencing and the dimensions of the corresponding garden.

- A. $x = 5\text{ ft}$
- B. $x = 10\text{ ft}$
- C. $x = 15\text{ ft}$
- D. $x = 20\text{ ft}$



Question 2: A square sheet of cardboard 18 inches on a side is made into an open box without top, by cutting squares of equal size out of each corner and folding up the sides along the dotted lines. Find the dimensions of the box with the maximum volume.

- A. $5 \times 5 \times 2$
- B. $10 \times 10 \times 3$
- C. $12 \times 12 \times 3$
- D. $15 \times 15 \times 4$



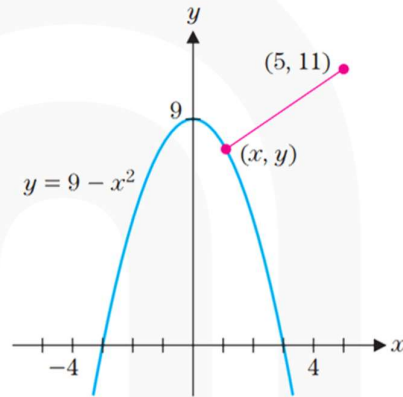


Topic: Optimization 2

Worksheet

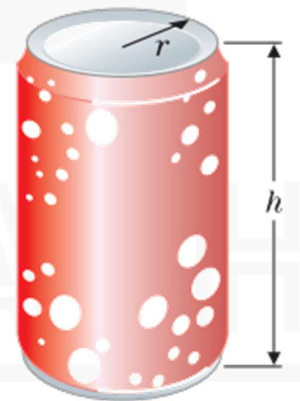
Question 1: Find the point on the parabola $y = 9 - x^2$ closest to the point $(5, 11)$.

- A. $(0.8, 8.4)$
- B. $(1.6, 12.2)$
- C. $(-0.8, -4.2)$
- D. $(2.4, -4.8)$



Question 2: A soda can is to hold 12 fl oz. Find the dimensions that will minimize the amount of material used in its construction, assuming that the thickness of the material is uniform i.e. the thickness of the aluminium is the same everywhere in the can.

- A. $h = 1.6$ m
- B. $h = 2.4$ m
- C. $h = 3.02$ m
- D. $h = 3.20$ m





Topic: Related Rates 1

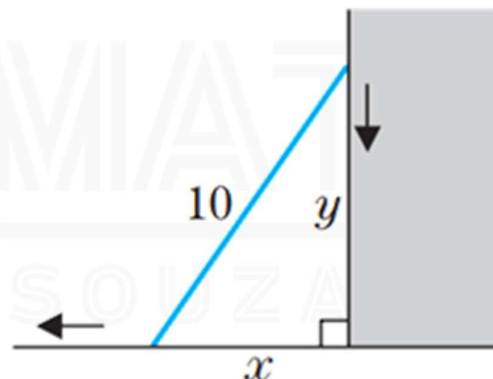
Worksheet

Question 1: An oil tanker has an accident and oil pouts out at the rate of 150 gallons per minute. Suppose that the oil spreads onto the water in a circle at a thickness of $\frac{1}{10}$ ". Given that 1 ft^3 equals 7.5 gl, determine the rate at which the radius of spill is increasing when the radius reaches 500 gallons.

- A. $r'(t) = 0.76 \text{ ft/min}$
- B. $r'(t) = 1.28 \text{ ft/min}$
- C. $r'(t) = 1.76 \text{ ft/min}$
- D. $r'(t) = 2.35 \text{ ft/min}$

Question 2: A 10 feet ladder leans against the side of a building. If the top of the ladder begins to slide down the wall at the rate of 2 ft/sec, how fast is the bottom of the ladder sliding away from the wall when the top of the ladder is 8ft off the ground?

- A. $x'(t) = 0.67 \text{ ft/sec}$
- B. $x'(t) = 1.32 \text{ ft/sec}$
- C. $x'(t) = 2.18 \text{ ft/sec}$
- D. $x'(t) = 2.67 \text{ ft/sec}$



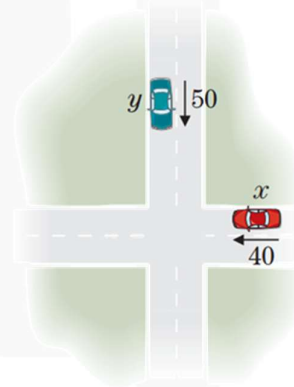


Topic: Related Rates 2

Worksheet

Question 1: A car travels at 50 mph due south at a point $\frac{1}{2}$ mile north of an intersection. A police car is traveling at 40 mph due west at a point $\frac{1}{4}$ mile east of the same intersection. At that instant, the radar in the police car measures the rate at which the distance between the two cars is changing. What does the radar gun register?

- A. 12.4 mph
- B. 38.6 mph
- C. 52.1 mph
- D. 62.6 mph



Question 2: A spectator at an air show is trying to follow the flight of a jet. The jet follows a straight path in front of the observer at 540 mph. At its closest approach, the jet passes 600 feet in front of the person. Find the maximum rate of change of the angle between the spectator's line of sight and a line perpendicular to the flight path, as the jet flies by.

- A. $\theta'(t) = 0.66 \text{ rad/sec}$
- B. $\theta'(t) = 1.32 \text{ rad/sec}$
- C. $\theta'(t) = 2.24 \text{ rad/sec}$
- D. $\theta'(t) = 2.90 \text{ rad/sec}$

