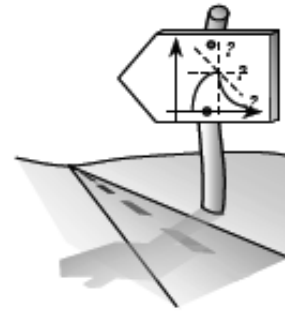


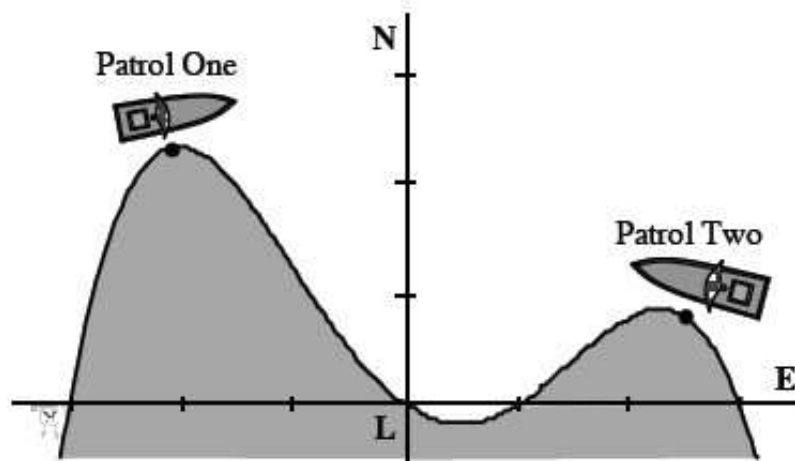
3.4.4 Trouble off Pythagoras Bay

Intersection of Tangents



3-182. TROUBLE OFF PYTHAGORAS BAY

The pleasure boat Suluclac is stranded off the coast of Pythagoras Bay, whose coastline can be represented by the curve below. Two patrol boats are heading back towards the lighthouse along the coastline, one from the east and the other from the west. Both boats have strong searchlights that are fixed and mounted to the front of each boat. Below are the reports called in from each of the boats.



"Patrol One calling in. We are currently 2.10 miles west and 2.32 north of the lighthouse on the coastline and we spot the Suluclac in our direct line of site."

"Patrol Two here. We have the ship spotted in our direct line of site and our location is 2.50 miles east and slightly north of the lighthouse on the coastline."

The patrol path is shown above along with a sketch of the portion of the coastline that is being patrolled by the two boats. The lighthouse is located at (0, 0). The scale for the sketch is one mile for each unit traveled directly east or west of the lighthouse.

- Using the model and the information provided from the patrol boats, find a polynomial function that can model the coastline relative to the location of the port.
- Find the lines that will represent the direct line of sites from each patrol boat to the Suluclac.
- What is the position of the Suluclac and how far is it from the lighthouse?



3-183. Determine algebraically whether $y = 2x^3 - 5x^2 + 1$ is concave up or concave down at $x = 0$ and at $x = 2$. Then, verify your solution with a graph of y'' . [Homework Help](#)

3-184. Find the antiderivative $F(x)$ for each function below. Test your solution by verifying that $F'(x) = f(x)$. [Homework Help](#)

a. $f(x) = 4x^{-3} + \frac{1}{2}x - 3$

b. $f(x) = \frac{6}{x^2}$

3-185. If $f(x) = 3 - x$ and $g(x) = \frac{1}{3-x}$ find and simplify $h(x) = f(g(x))$ and $j(x) = g(f(x))$. Does $h(x) = j(x)$? [Homework Help](#)

3-186. Write a Riemann sum to estimate $A(f, 5 < x < 13)$ for $f(x) = 4\sqrt[3]{x-5}$ using n left endpoint (or other) rectangles. Then calculate the area for $n = 8, 20$, and 50 rectangles. Which is most accurate and why? [Homework Help](#)

3-187. HANAH STRIKES AGAIN!

To calculate the slope of a line tangent to $f(x)$ at $x = a$, most graphing calculators use Hanah's method from problem 3-35, formally called the **Symmetric Difference Quotient**, shown below. [Homework Help](#)

$$\lim_{h \rightarrow 0} \frac{f(x+h) - f(x-h)}{2h}$$

- Use the symmetric difference quotient to find $f'(x)$ if $f(x) = 3x - 2$.
- Use this symmetric difference in your graphing calculator to graph $f'(x)$ for $f(x) = \sin x$ for $h = 0.001$.

3-188. ANOTHER PROBLEM FOR HANAH [Homework Help](#)

- a. Graph $y = x^{2/3}$ on graph paper and *without your calculator*, sketch $\frac{dy}{dx}$.
- b. What happens to $\frac{dy}{dx}$ at the vertex?
- c. Use your graphing calculator to find the slope of $y = x^{2/3}$ at the vertex. What happened?
- d. Part of the reason most graphing calculators incorrectly determine slopes at the vertex of an absolute value graph, as well as other cusps, is because they use the symmetric difference quotient to calculate the slope of a tangent.



For $f(x) = |x|$, use

$$\frac{f(x+h) - f(x-h)}{2h}$$

to calculate $f'(-0)$ for $h = 0.1$, -0.1 , and 0.01 . What do you notice? What leads the calculator to falsely find a derivative of $f(x) = |x|$ at $x = 0$?

3-189. Without your calculator, find the equation of the tangent line to $g(z) = \frac{z^7 + 5z^6 - z^3}{z^2}$. Homework



Help 

3-190. Determine algebraically where $y = x^3 + \frac{3}{2}x^2 - 6x + 2$ is decreasing. Then, check with a graph of y on your graphing calculator. How did a derivative help? Homework Help 