

1.  $f(x) = x^3 - 9x^2 + 24x - 7$

- a) Find the intervals on which  $f(x)$  is increasing.
- b) Find the intervals on which  $f(x)$  is decreasing.
- c) Find relative maximum and minimum point(s).
  - i) Candidates
  - ii) Proof:
  - iii) Results
- d) Find the open intervals on which  $f(x)$  is concave upward.
- e) Find the open intervals on which  $f(x)$  is concave downward.
- f) Find the point(s) of inflection.
  - i) Candidates
  - ii) Proof:
  - iii) Results

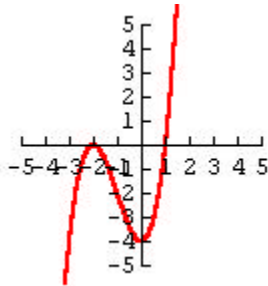
2.  $f(x) = \frac{6x}{x^2 + 3}$

- a) Find the intervals on which  $f(x)$  is increasing.
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- d) Find the open intervals on which  $f(x)$  is concave upward.
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3.  $f(x) = x^5$

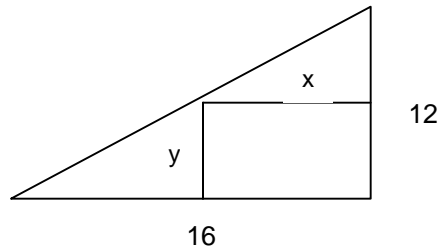
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- Candidates
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  - Results
4. Find the interval(s) over which  $f(x) = x^{4/3} - x^{1/3}$  is decreasing
5. Find the x value that produces the minimum value of  $y = x^2 \ln x$ .
6. Find the x value that produces the relative maximum and minimum points of  $f(x) = x\sqrt{3} - 2\sin x$  for  $0 < x < 2\pi$
- Candidates:
  - Proof
  - Result
7. Find the absolute maximum and minimum values of  $f(x) = x^3 - 27x$  on the closed interval of  $[-4, 4]$ .
8. Use the graph of the position function to determine the signs of the velocity and acceleration at the given points. Then determine whether the particle is speeding up or slowing down at those points.



9. A particle is moving along a line with position function  $s(t) = 4t^3 - 33t^2 + 72t + 8$  for  $t \geq 0$ . Find:
- $v(t)$
  - $a(t)$
  - the times that the particle is stopped
  - the time intervals when the particle is slowing down
  - the time intervals when the particle is speeding up
10. A ball is thrown vertically upward from the ground with an initial velocity of 96 feet per second.
- Find  $s(t)$ .
  - Find  $v(t)$ .
  - In how many seconds will the ball reach its maximum height?
  - Find the maximum height.
  - Find the speed when it hits the ground.

11. An item is dropped at the top of a tall building. How many meters does it fall in 2 seconds?
12. A rectangle is to be inscribed in a right triangle having sides of length 12, 16, and 20 inches. Find the dimensions of the rectangle with greatest area. Use the given sketch.



13. A closed box with square base and vertical sides is to be built. The bottom of the box and all four sides are to be made of material costing \$1/sq. ft, and the top is to be constructed of glass costing \$5/sq ft. What are the dimensions of the box of greatest volume that can be constructed for \$72?
14. A box with no top is to be built by taking an 8 inch by 15 inch sheet of cardboard and cutting  $x$ -inch squares out of each corner and folding up the sides. Find the value of  $x$  that maximizes the volume of the box.
15. What are the dimensions of the lightest open-top right circular cylindrical can that can be made of material weighing 1 gram per square centimeter if the volume of the can is to be 1000 cubic centimeters?
16. Use Newton's method to estimate the positive solution of the equation  $x^3 - 4x - 1 = 0$ . Show all approximations and give the answer to the display accuracy of your calculator. Show the equation for  $x_{n+1}$
17. Use Newton's method to estimate the  $x$ -coordinate of the point of intersection of  $y = x^3$  and  $y = 0.5x + 6$ . Show all approximations and give the answer to the display accuracy of your calculator. Show the equation for  $x_{n+1}$