

1. Determine the critical points of the function and find the intervals on which the function is increasing and decreasing. Use this information to find relative maxima and relative minima of the function.

a) $f(x) = x^3 - 3x + 8$

b) $f(x) = x^5 - (5/2)x^4 - 10$

c) $f(x) = x^5 - 5x^4 + \left(\frac{20}{3}\right)x^3 - 5$

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

e) $f(x) = \frac{x}{x+1}$

2. Find $\frac{dy}{dx}$.

a) $2x^3 - 3xy = 4$

b) $x^2 + 2x^2y^2 + y^2 = 10$

3. Find the second derivative of the function.

a) $f(x) = \frac{1}{x^2+1}$

b) $g(t) = t(t^2 + 1)^3.$

4. Show that if $f(x) + g(y) = 0$ and f and g are differentiable, then $\frac{dy}{dx} = -\frac{f'(x)}{g'(y)}$.

5. A spherical bubble is being filled with air at a rate of $8 \text{ cm}^3/\text{s}$. How fast is the radius of the bubble increasing when $r = 3 \text{ cm}$? (The volume of a sphere is $V = \frac{4}{3}\pi r^3$).

6. An actor on a stage walks toward a foot-light at the front of the stage at a rate of 3 ft/s . The foot-light is 30 ft from the back of the stage and the actor is 6 ft tall. How fast is the height of the actor's shadow growing? Hint: use similar triangles.

