

1. Find dy/dx using explicit or implicit differentiation

a. $y = 5x^3 - 4x^2 + 3$ [1 pt]

b. $y = 2\sin x - 3\tan x$ [1 pt]

-0.5 $\frac{15x^2 - 8x}{(2\cos(x))^3 - 3}$ } why? did you do this on calculator?

c. $y = -4\sin 5x + \ln 3x + e^{4x}$ [2 pts]

-0.5 $\frac{4x e^{4x} + 1}{x} - 20\cos(5x)$ if done by hand it wouldn't look like this

d. $y = 3x^2 \sin x$ [2 pts]

$3x^2 \cos(x) + 6x \sin(x)$

e. $y = \log(2x^4 - 5x)$ [2 pts]

-0.5 $\frac{1}{(2x^4 - 5x)} \cdot (8x^3 - 5)$ close → look up formula for $\frac{d}{dx} \log x$

f. $y = \frac{3x^2 + 2x}{e^{2x}}$ [2 pts]

-0.5 $(-6x^2 + 2x + 2)e^{-2x}$ work?

g. $x^2 y^2 + x \sin y = 4$ [3 pts]

$(2x \cdot 2y + (\sin y + x \cos y))$

-2

$\frac{-2xy^2}{(2x^2y + \frac{d}{dx}(x \sin(y)))}$ ← so $y' = ?$

-4

2. Find the equation of the line tangent to the curve $x^3 + 3x^2 = y^2$ at $x = 2$ [4 pts]

First take the derivative:

$$\frac{3x(x+2)}{2y}$$

$m =$

$$x = \frac{12}{y}$$

how?

$$y_2 - y_1 = m(x_2 - x_1)$$

numbers?

3. Solve the following related rates problems:

a. If $x^3 + 2y^2 = 45$ and $dy/dt = 4$, find dx/dt when $y = 3$ [3 pts]

$x =$

$$x^3 + 2y^2 = 45 \quad y' = 4, y = 3$$

$$3x^2 \cdot x' + 4y \cdot y' = 45$$

oops

plug in #'s

b. A spherical snowball rolls down the mountain. For each second it's moving, it collects 20 cubic inches of additional snow (dV/dt). Find the rate at which the radius is increasing (dr/dt) when the diameter is 10 inches. [4 pts]

$$\frac{dV}{dt} = 20$$

$$d = 10$$

$$V = \frac{4}{3} \pi R^3$$

$$R = 5$$

$\frac{dr}{dt} = ?$

$$V = \frac{4}{3} \pi R^3$$

$$= 4\pi R^2 \cdot R'$$

$$20 = 4\pi (5)^2 \cdot R'$$

$$20 = 4\pi 25 \cdot R'$$

$$20 = 100\pi \cdot R'$$

$$\frac{\pi}{5} = R'$$

good oops

c. Regarding the snowball above, Is dr/dt going to be larger when the diameter is 15 inches or 20 inches? Why? [2 pts]

yes because the snowball going to
get more collect more additional
snow in less time!
at 15 or 20?

4. Given the function $f(x) = 0.25x^4 - \frac{4}{3}x^3 - 4.5x^2 + 36x - 12$, solving the following using calculus/algebra:

a. Where are the roots? (find by graphing on your calculator) [1 pt]

-1 (?)

b. On what intervals is the function positive? Where is it negative? [1 pt]

-0.5 ~~$(-\infty, 1)$~~ $(1, \infty)$ } depends on roots positive or negative?

c. Where are the critical values? [2 pts]

-1 $x = -3$ $x = 3$ $x = 4$
work? how?

d. On what intervals is the function increasing? Where is it decreasing? [2 pts]

-2 (?)

e. Give the maxima and minima as points in the form (x, y) and label each as a maximum/minimum [2 pts]

-1 minimum = $(-3, -63.75)$ maximum = $(3, 39.75)$
missing one y-value from given curve?

f. Find the points of inflection [2 pts]

-2 (?)

g. On what intervals is this curve concave up? Where is it concave down? [2 pts]

-1 concave up at $x = -3$ concave down at $x = 3$
use points of inflection

5. Campbell's asks you to determine which of the following can shapes will be the cheapest for a new line of soup that will come in quantities of 250 cm^3 . The aluminum costs 1 cent for 10 cm^2 , and the label costs 8 cents (size/shape doesn't matter).

a. Find the minimal cost of a cube to hold the soup. [4 pts]

~~Answer~~ $A = s^3$

$$A = 3s^2$$

$$250 = 3s^2$$

Find critical numbers

don't actually need to do this for this problem

-3

b. Find the minimal cost of a cylinder to hold the soup. [4 pts]

$$2\pi R^2 + 2\pi r h$$

$$V = \pi r^2 h$$

$$= 2\pi r h$$

what about this?

-3

(?)

6. Find the linearization of the function of $y = \sqrt{x-2}$ at $x=6$ and use it to approximate $\sqrt{3.96}$ [3 pts]

what's this?

$a=4$

$$L(a) = F(a) + F'(a)(x-a)$$

$$= 2 - (0)(3.96 - 4)$$

use 5.94

at 6 function

-2