

## MATH 111-007 RECITATION 1020

OCTOBER, 20TH, 2021

**Problem 1.** Given  $f(x) = 4 - x^2$ ; find  $f'(-3)$ ,  $f'(0)$  and  $f'(1)$ .

**Problem 2.** Find  $\frac{dz}{dw}$  if  $z = \frac{1}{\sqrt{w^2-1}}$ .

**Problem 3.** Find the equation of the tangent line to the curve  $y = \frac{4x}{x^2+1}$  at  $x = 1$ . Find the coordinates  $(x, y)$  where the tangent lines are flat.

**Problem 4.** Find the point on the graph  $f(x) = \frac{x^2}{2} + 4$  with tangent line perpendicular to the line  $y = \frac{x}{2} + 3$ .

**Problem 5.** Find the value of  $a$  that makes the following function differentiable for all  $x$ -values.

$$g(x) = \begin{cases} ax, & \text{if } x < 0, \\ x^2 - 3x, & \text{if } x \geq 0. \end{cases}$$

**Problem 6.** Find the value of  $a$  and  $b$  that make the following function differentiable for all  $x$ -values.

$$f(x) = \begin{cases} ax + b, & \text{if } x > -1, \\ bx^2 - 3, & \text{if } x \leq -1. \end{cases}$$

**Problem 7.** Find  $\frac{d}{dx}(2^{\tan(x)})$ .

**Problem 8.** Find  $\frac{d}{dx}(\tan^{-1}(\sqrt{x}))$ .

**Problem 9.** Suppose  $u(x)$  is differentiable at  $x = 2$  and  $u(2) = 9$ ,  $u'(2) = -3$ . Find the derivative of  $y = x^2\sqrt{u(x)}$  at  $x = 2$ .

**Problem 10.** Find  $\frac{d}{dx} \arcsin(e^{2x})$ .

**Problem 11.** Evaluate  $\sin(\arctan(1))$ .

**Problem 12.** Find  $\frac{d}{dt}(\ln(3e^{-t}))$ . Why does the result make sense? Which set of functions have constant derivatives (as a function)?

**Problem 13.** The number of gallons of water in a tank  $t$  minutes after the tank has started to drain is  $Q(t) = 200(30 - t)^2$ . How fast is the water running out at the end of 10 min? What is the average rate at which the water flows out during the first 10 min? How do these compare?

**Problem 14.** Find the derivative of  $\sqrt{x\sqrt{x}}$ . It's simpler than it looks.

**Problem 15.** Find the equation of the tangent and normal to the curve at the given point.

$$x^2 \cos^2 y - \sin y = 0, \quad @ (0, \pi).$$