Math 1110-101 **Homework #2** **Due: Wed., July 26^{th}, 2023**

#1 A rocket is launching and you are trying to record it taking off. The launchpad is 3000 feet away. The rocket flies up vertically and when it gets 4000 feet above the launchpad it is traveling at 880 feet per second. Looking at the rocket, consider the angle your line of sight is making with the ground (this is the angle you need to tilt your camera up). How fast is this angle changing? [Find your answer in radians per second and then convert to degrees per second.]

#2 The surface area of a cylindrical can of radius r and height h is given by $S = 2\pi r(r + h)$.

(a) If we change the height of the cylinder at a rate of 0.1 units per minute from a height of 3 when the radius is fixed at 2, how fast is the surface area changing?

(b) If we change the height of the cylinder at a rate of 0.2 units per minute, decrease the radius at a rate of 0.1 units per minute when the height is 3 and the radius is 2, how fast of the surface area changing? Is the surface area increasing or decreasing?

(c) Suppose the surface area is changing at a rate of 28π square units per minute when the radius is 2 and the fixed height is 3, how fast is the radius changing?

Math 1110-101 **Homework #3** **Due: Fri., July 28^{th}, 2023**

#1 Find the point on the parabola $x = 2y^2$ that is closest to $(x, y) = (0, 9)$.

#2 A cylindrical can with an open top needs to hold 500 cm^3 of liquid. Find the height and radius that minimize the about of material needed to manufacture this can.

#3 Taylor polynomial questions.

(a) Find the quadratic approximation of $\sec(x)$ based at $x = 0$.
Use your approximation to estimate $\sec(0.1)$.

(b) Find the quadratic approximation of $f(x) = x^5$ based at $x = -1$.

(c) Find the fourth order Maclaurin polynomial for $g(x) = e^{-2x}$.

(d) Suppose the fourth order Taylor polynomial based at $x = 3$ of $h(x)$ is

$$P(x) = -8 + (x - 3) - (x - 3)^3 + 10(x - 3)^4.$$

List $h(3)$, $h'(3)$, $h''(3)$, $h'''(3)$, and $h^{(4)}(3)$.
Is it possible to use $P(x)$ to determine any other values of h or its derivatives?