MATH 140
SPRING 2019 NAME:
EXAM 2

1. $\boxed{\text{10 pts. each}}$ Find the derivative.

   (a) $s(t) = (2t - \sin t)^{3/2}$

   (b) $f(\theta) = \cos(\sec(\tan\theta))$

2. $\boxed{\text{10 pts.}}$ At what point on the curve $y = \sqrt{1+4x}$ is the tangent line perpendicular to the line $6x + 2y = 1$?

3. $\boxed{\text{10 pts.}}$ For $\cos(xy) = 1 + \sin y$ find y' using implicit differentiation.

4. $\boxed{\text{10 pts.}}$ Using implicit differentiation, find an equation of the tangent line to the curve

$$y^4 - 4y^2 = x^4 - 5x^2$$

at the point $(0, -2)$.

5. $\boxed{\text{5 pts. each}}$ If a ball is thrown vertically upward with a velocity of 80 ft/s, then its height after t seconds is $h(t) = 80t - 16t^2$.

   (a) What is the maximum height reached by the ball?

   (b) What is the velocity of the ball when it is 96 ft above the ground on its way down?

   (c) With what velocity does the ball hit the ground?

6. $\boxed{\text{10 pts.}}$ The length of a rectangle is increasing at a rate of 8 cm/s and its width is increasing at a rate of 3 cm/s. When the length is 20 cm and the width is 10 cm, how fast is the area of the rectangle increasing?

7. $\boxed{\text{15 pts.}}$ Water is leaking out of an inverted conical tank at a rate of 10,000 cm^3/min at the same time that water is being pumped into the tank at a constant rate. The tank has height 6 m and the diameter at the top is 4 m. If the water level is rising at a rate of 20 cm/min when the height of the water is 2 m, find the rate at which water is being pumped into the tank.

8. $\boxed{\text{10 pts.}}$ Use a linear approximation (or differentials) to estimate the value of $\sqrt[3]{1003}$.

9. $\boxed{\text{10 pts.}}$ Find the absolute maximum and absolute minimum values of

$$f(x) = 3x^4 - 4x^3 - 12x^2 + 1$$

on the interval $[-2, 3]$.

10. $\boxed{\text{10 pts.}}$ Show that the equation $2x - 1 - \sin x = 0$ has exactly one real root.

11. $\boxed{\text{10 pts.}}$ If $f(1) = 10$ and $f'(x) \geq 2$ for $1 \leq x \leq 4$, what's the smallest that $f(4)$ can possibly be?