Math 140
Summer 2020 Name:
Exam 2

1. $\boxed{\text{10 pts. each}}$ Use differentiation rules to find the derivative of each function.

   (a) $r(t) = 3\sqrt[3]{t} - \frac{3}{4}t^8 - t + 10$

   (b) $G(\ell) = \dfrac{2\ell - 1}{\sqrt{\ell} + 2}$

   (c) $f(x) = x \sin x \cos x$

   (d) $y = \dfrac{\cot x}{1 + \csc x}$

2. $\boxed{\text{10 pts.}}$ Determine the constants A and B so that the line tangent to

$$f(x) = x^2 + Ax + B$$

at $x = 2$ is $y = 4x + 2$.

3. $\boxed{\text{10 pts. each}}$ Find the derivative of the function using the Chain Rule.

   (a) $y = (2x^6 + x)^8$

   (b) $y = \tan \sqrt{x}$

   (c) $h(x) = \sec^4(\cos 5x)$

4. $\boxed{\text{10 pts.}}$ Use implicit differentiation to find dy/dx, given that

$$(xy + 1)^3 = x - y^2 + 8.$$

5. $\boxed{\text{15 pts.}}$ Find an equation of the tangent line to the curve given by

$$\cos(x - y) + \sin y = \sqrt{2}$$

at the point $(\pi/2, \pi/4)$.

6. $\boxed{\text{10 pts.}}$ The height of a triangle is decreasing at a rate of 2 cm/min while the area is increasing at a rate of 3 cm^2/min. At what rate is the base of the triangle changing when the height is 12 cm and the area is 150 cm^2?

7. $\boxed{\text{15 pts.}}$ An inverted conical water tank with a height of 12 ft and a radius of 6 ft is drained through a hole at the vertex at a rate of 2 ft^3/s. What is the rate of change of the water depth when the water depth is 3 ft? (Hint: Use similar triangles.)