Name: _____

Write all of your responses on these exam pages, use the back if necessary. Show all your work, answers without supporting justification will not receive credit.

1. (*45 Points*): Find the first derivatives of the following functions. You do not need to simplify your answers.

   (a) $f(x) = x^{3/2} + x^{-3}$

   (b) $f(x) = (3x^2 - 5x)e^x$

   (c) $f(x) = \dfrac{x^2 e^x}{x^2 + e^x}$

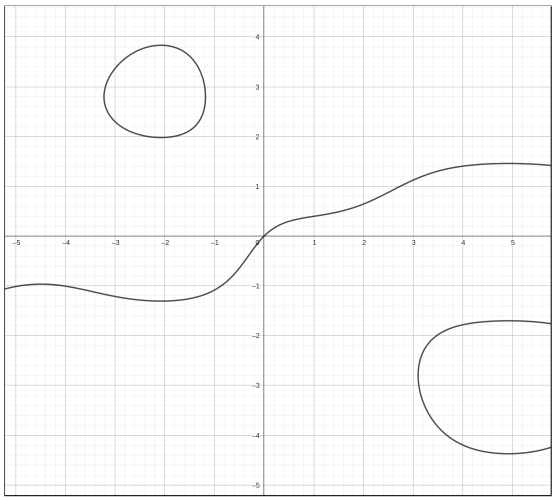
(d) $f(x) = \dfrac{x}{2 - \tan(x)}$

(e) $f(x) = \sin\left(\dfrac{e^x}{1 + e^x}\right)$

2. (*15 Points*): Find the derivative of the following implicit relationship.

$$ye^{\sin(x)} = x\cos(y)$$

Then find the tangent line to the curve at the point $(0, 0)$.



3. (*10 Points*): Find the derivative of $f(x) = x^x$ using logarithmic differentiation.

4. (*10 Points*): Find the following limit.

$$\lim_{x \to 0} \frac{\tan(2x)}{x}$$

5. (*20 Points*): The height (in meters) of a projectile shot vertically upward from a point 2 meters above ground level with an initial velocity of 24.5 m/s is $h = 2 + 24.5t - 4.9t^2$ after t seconds.

   (a) Find the velocity after 2 seconds and after 4 seconds.

   (b) When does the projectile reach its maximum height?

   (c) What is the maximum height?

(d) When does it hit the ground?

(e) With what velocity does it hit the ground?

6. (*10 Points*): The altitude of a triangle is increasing at a rate of 1 cm/min while the area of the triangle is increasing at a rate of 2 cm^2/min. At what rate is the base of the triangle changing when the altitude is 10 cm and the area is 100 cm^2?