Assignment Six

We shall find the Cube of the Rainbow.
Of that, there is no doubt.
But the Arc of a Lovers conjecture
Eludes the finding out.
-Emily Dickinson

For Tuesday workshop this week, you will present the results of last week’s assignment.

1. (Thursday Workshop/Practice Exam 1) The graph of \( f(x) = \frac{x^2-2x}{x-1} \) is shown.

(a) Sketch the reflection of this graph across the line \( y = x \) and the partial inverse function given by choosing \( y > 1 \).

(b) Find the derivative of this partial inverse function at the points \((0, 2)\) and \((\frac{3}{2}, 3)\).

2. (Thursday Workshop/Practice Exam 1) Compute the following (no partial credit):

(a) \( \frac{d}{dx} 12x^5 - 2x^2 + x + 11 - 3x^{-1} \) at \( x = 1 \).

(b) \( \frac{d}{dt} \sin(5t^3 + 2t) \)

(c) \( f'(x) \) if \( f(x) = x^2 \sin(2x) \)

(d) \( f'(5) \) if \( f(t) = e^{3t+2} \)

(e) \( \frac{d}{da} 4ae^{-5a} \)

(f) \( f'(0) \) if \( f(x) = 10\cos(x)-10x \)

(g) \( f'(u) \) if \( f(u) = 4ue^u(1 + \tan(u)) \)

(h) \( \frac{d}{dx} \frac{(x+2)^3}{(3x-1)^2} \)

(i) \( \frac{d}{du} \ln(u^2 + 1) \arcsin(u) \)

(j) \( \frac{d}{d\theta} \tan(\theta)^2 \sec(\theta)^4 \)

3. (Thursday Workshop/Practice Exam 1) Section 3.4, problem 34. Section 4.5, problem 1.

4. (Practice Exam 2) Find the derivative of \( f(x) = \sqrt{\arctan(x)\ln(x^3+1)} \). Justify each step of the calculation.

5. (Practice Exam 2) Section 4.5, problem 13.
6. (Practice Exam 2) Compute the following (no partial credit):

(a) \( \frac{dy}{dx} \) if \( y = 4xe^{2x} - 9x \)
(b) \( \frac{d}{dt} \cos t \)
(c) \( \frac{d}{dt} \cos t \)
(d) \( f'(x) \) if \( f(x) = \log_2(\sin(5x)) \)
(e) \( g'(7) \) if \( g(x) = e^{\sqrt{2x-5}} \)
(f) \( f'\left(\frac{\pi}{2}\right) \) if \( f(\theta) = (\cos \theta)(1 - \sin 2\theta) \)
(g) \( y'(x) \) if \( y(x) = 5x \arcsin(2 + 5x) \)
(h) \( \frac{d}{dr} \csc 3r \)
(i) \( \frac{d}{dx} \ln(4e^{3x}) \)
(j) \( \frac{d}{d\arctan(3t^2)} \frac{1}{3t^2} \)

7. (Practice Exam 2) The graph of the elliptic curve \( y^2 = x^3 - x \) is shown.

(a) Find the slope of the tangent line at an arbitrary point \((x, y)\) on the curve.
(b) Sketch the graph of the implicit function \( y = \sqrt{x^3 - x} \).

8. Section 3.5, problems 5, 6, 7.

9. Following the methods we used for \( \arcsin \) and \( \arctan \), define \( \text{arcsec}(x) \) and find its derivative.

10. Sketch graphs of the derivatives of the following functions: