For full credit show all of your work (legibly!), unless otherwise specified. Answers may include all arithmetic operations, trigonometric functions, inverse trigonometric functions, and natural logarithms. Algebraic simplification of answers is unnecessary.

1. **(10 points)** For $g(x) = \operatorname{arcsec}(xe^x)$, calculate $g'(x)$.

2. **(18 points)** The *cissoid of Diocles* is a curve satisfying the equation $x(x^2 + y^2) = 4y^2$.

    (a) **(14 points)** Find a formula for $\frac{dy}{dx}$ on this curve.

    (b) **(4 points)** Find the equation of the tangent line to the curve at $(2, -2)$.

1		/ 10
2		/ 18
3		/ 10
4		/ 8
5		/ 12
6		/ 12
7		/ 18
8		/ 12
Σ		/100

3. **(10 points)** Find an equation of the tangent line to the curve $y = (3 + \ln x)x^2$ at $(1, 3)$.

4. **(8 points)** Estimate the following values using appropriate linear approximations.

   (a) **(4 points)** $\sqrt{35.97}$.

   (b) **(4 points)** $(-2.95)^5$.

5. **(12 points)** Find the maximum and minimum values of the function $f(x) = \frac{3x+1}{x^2+1}$ on the interval $[0, 7]$.

6. **(12 points)** If $y = e^{\sqrt{\tan \theta}}$, determine $\frac{dy}{d\theta}$.

7. **(18 points)** Andrés, Brigid, and Cassius are each carrying radio receivers designed to survey the triangular area with the receivers at the corners. Andrés is standing motionless. Brigid is 5 miles north of Andrés and walking south at 3 miles per hour; Cassius is 12 miles to Andrés's east and is running east at 6 miles per hour.

   (a) **(8 points)** Is the area they are monitoring growing or shrinking, and at what rate?

   (b) **(10 points)** If Brigid needs to keep an antenna pointed directly at Cassius's receiver, how quickly should she be rotating it to keep it fixed on him while they both move?

8. **(12 points)** Calculate $\frac{d}{dt} \frac{\arctan(t^3)}{\arcsin t}$.