

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)** Find an equation of the tangent line to the curve $y = x \arcsin x$ at $(\frac{1}{2}, \frac{\pi}{12})$.

2. **(18 points)** A ten-inch long rod made of wax is firmly attached to the floor (with a swivel) eight inches from a vertical heater, which it is leaning on. The heater is melting away half an inch of wax from the free end of the rod each second.

(a) **(8 points)** How quickly is the free end of the rod sliding down the heater?

(b) **(10 points)** How quickly is the angle between the rod and the floor changing?

1	/ 10
2	/ 18
3	/ 18
4	/ 10
5	/ 12
6	/ 8
7	/ 12
8	/ 12
9	/ (5)
Σ	/100

3. (18 points) The *right strophoid* is a curve satisfying the equation $xy^2 + 5y^2 = 5x^2 - x^3$.

(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 $(-3, 6)$.

4. (10 points) For $g(t) = e^t(\sin \ln t)$, calculate $g'(t)$.

5. (12 points) Find $\frac{d}{dx} \arctan \sqrt{e^x}$.

6. (8 points) Estimate the following values using appropriate linear approximations.

(a) (4 points) 1.007^6 .

(b) (4 points) $\sqrt[3]{-26.9973}$.

7. (12 points) Find the maximum and minimum values of the function $f(x) = \frac{x^2+2x+10}{x+1}$ on the interval $[0, 5]$.

8. (12 points) For $y = \sqrt{\frac{e^x+2}{\ln x} + 1}$, calculate $\frac{dy}{dx}$.