

Name: _____

1. Suppose a mechanical watch is dropped on a concrete floor. If the total number of ticks of the watch t seconds later is given by $W(t) = te^{-0.001t}$, find a formula for the speed of the watch after t seconds. How fast is the watch ticking after 60 seconds?

For problems 2-3, find the derivative of the given function.

2. $\frac{e^x}{3^x + x^3}$.

3. $\sin(\cos(x))$.

4. Find all inflection points of $\ln(x^2) + 25x^2$.

5. Find all local maxima and minima of $f(x) = \frac{256x^3}{3} - \frac{x^5}{5}$

6. Suppose a schooner captain falls asleep at the wheel. The tilt of the ship (in degrees starboard) t seconds after the captain wakes up is given by $D(t) = \frac{30}{2t^3 - 15t^2 + 36t + 1}$. Find the maximum tilt of the ship.

7. Find the minimum average cost for the cost function pictured below.

8. Suppose the demand (in gallons) for Vichyssoise at a soup kitchen is given by $q = 500e^{-0.1p}$. Find the Elasticity of demand when the price is \$5.00. Should the price be raised or lowered?

9. (Bonus 25 pts) Prove the constant multiple rule: $\frac{d}{dx} [cf(x)] = c \frac{d}{dx} f(x)$.

10. (Bonus 25 pts) Find $g'(x)$ for $g(x) = x^x$. (Hint: take the natural log of both sides and use implicit differentiation).