

Show all relevant work!

YOU MAY USE A CALCULATOR TO VERIFY SOLUTIONS, BUT NOT TO PROVIDE THEM.

1. Suppose $h(x) = (f(x))^3$. If $f(1) = -2$ and $f'(1) = 5$, find $h'(1)$.
2. The half-life of Pu-238 is 88 years. Let Q_0 represent the initial quantity of Pu-238 and assume the decay of the element is continuous.
- (a) Using base e , write the particular equation giving the quantity, Q , in grams as a function of time, t , in years.
- (b) Find $\frac{dQ}{dt}$ and explain what it represents. Include units in your explanation.
- (c) What is the continuous rate of decay from your model in (a)? Compare and contrast this rate with your answer to part (b).

3. The daily cost, C , of running an air conditioner in Arizona depends on the temperature, H , as shown in the first table. The temperature in turn increases with the time of day, t , as shown in the second table. Determine the rate at which cost changes with time when $t = 10$ and interpret the result.

H (in F°)	90	95	100	105	110
$C(H)$ (\$)	4	4.75	6	7.50	9.15

t (in hours past 00:00)	6	8	10	12	14
$H(t)$ (in F°)	90	97	100	112	119

4. Suppose $m'(x) = \frac{x^3}{\sqrt{1-x^4}}$. What is a possible formula for $m(x)$?

5. Show that $\frac{d}{dx} \arccos x = \frac{-1}{\sqrt{1-x^2}}$

6. Use the table below to help you find $\frac{d}{dx} f^{-1}(x)$ evaluated at $x = 4$.

x	0	1	2	3	4
$f(x)$	1	2	4	5	5.6
$f'(x)$	1	$\frac{9}{5}$	$\frac{3}{2}$	$\frac{4}{5}$	$\frac{1}{3}$

7. Show $\frac{d}{dx} b^x = \ln(b)b^x$.

8. Find $\frac{d}{dx} \log_b x$.

9. Where is $y = \arctan(1 - x^2)$ increasing and where is it decreasing? Where is it concave up?