



Worksheet for the Derivative Test
 Name: Roberto García Flores A01570172
 Date: 3/22/21

1. Use the graph to find the intervals in which the graph of $f(x)$ is increasing or decreasing.

1) $f(x)$ increasing $x > 0$ 2) $f(x)$ increasing $x < 0$ & $x > 1$
 3) $f(x)$ decreasing $x < 0$ 4) $f(x)$ decreasing $x < 0$ & $x > 1$
 5) $f(x)$ increasing $f = \sin(2x) \cdot (1 - \cos(x + \pi))$ 6) $f(x)$ increasing $f = \cos(x)$
 7) $f(x)$ increasing $f = (x-2) \cdot \cos(x)$ 8) $f(x)$ increasing $f = (x-2) \cdot \cos(x)$
 9) $f(x)$ increasing $f = (x-2) \cdot \cos(x)$ 10) $f(x)$ increasing $f = (x-2) \cdot \cos(x)$

Related Rate: ok

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1. $\frac{dV}{dt} = 50\pi r^2$ $V = 4\pi r^3$
 $\frac{dV}{dt} = 4\pi(3r^2) \cdot \frac{dr}{dt} = 30\pi r^2 \cdot \frac{dr}{dt}$ $\frac{dr}{dt} = \frac{50}{4r}$

2. $A = \pi r^2$
 $\frac{dA}{dt} = 2\pi r \cdot \frac{dr}{dt} = 20\pi r \cdot \frac{dr}{dt}$ $\frac{dr}{dt} = \frac{30}{2r}$

3. $V = 4\pi r^3$ $A = 4\pi r^2$
 $\frac{dV}{dt} = 12\pi r^2 \cdot \frac{dr}{dt} = 4\pi(2r) \cdot \frac{dr}{dt} = 8\pi r \cdot \frac{dr}{dt}$ $\frac{dr}{dt} = \frac{30}{8r}$
 $\frac{dV}{dt} = 40\pi r^2 \cdot \frac{dr}{dt} = 8\pi r \cdot \frac{dr}{dt} = 40\pi r^2 \cdot \frac{dr}{dt} = 8\pi r \cdot \frac{dr}{dt}$ $\frac{dr}{dt} = \frac{40\pi r^2}{8\pi r} = 5\pi r$

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 Related Rates: Logarithmic Differentiation

1. $y = x^x$ $\ln y = \ln(x^x)$
 $\ln y = x \ln x$
 $\frac{d}{dx} \ln y = \frac{d}{dx} (x \ln x)$
 $\frac{1}{y} \cdot \frac{dy}{dx} = (\ln x + x \cdot \frac{1}{x}) = \ln x + 1$
 $\frac{dy}{dx} = y(\ln x + 1) = x^x(\ln x + 1)$

2. $y = e^{2x}$
 $\ln y = \ln(e^{2x}) = 2x$
 $\frac{d}{dx} \ln y = \frac{d}{dx} (2x)$
 $\frac{1}{y} \cdot \frac{dy}{dx} = 2$
 $\frac{dy}{dx} = 2y = 2e^{2x}$

3. $y = e^{\sin(x)}$
 $\ln y = \ln(e^{\sin(x)}) = \sin(x)$
 $\frac{d}{dx} \ln y = \frac{d}{dx} (\sin(x)) = \cos(x)$
 $\frac{1}{y} \cdot \frac{dy}{dx} = \cos(x)$
 $\frac{dy}{dx} = y \cos(x) = e^{\sin(x)} \cos(x)$

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1) $f(x)$ increasing $x < 0$ 2) $f(x)$ increasing $0 < x < 1$
 3) $f(x)$ decreasing $1 < x < 2$ 4) $f(x)$ increasing $x > 2$

2. Find the intervals of concavity for $f(x) = x^3 - 3x^2 + 2x$.

a) $f'(x) = 3x^2 - 6x + 2$
 $f''(x) = 6x - 6$
 $f''(x) = 0 \Rightarrow 6x - 6 = 0 \Rightarrow x = 1$
 b) $f''(x) > 0 \Rightarrow 6x - 6 > 0 \Rightarrow x > 1$
 c) $f''(x) < 0 \Rightarrow 6x - 6 < 0 \Rightarrow x < 1$

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4. Find the intervals of concavity for $f(x) = x^3 - 3x^2 + 2x$.

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