

King Fahd University of Petroleum and Minerals
Department of Math & Stat
Math 132, Sections 1, 4 (102)
Quiz 2(a)

Time: 20 minutes

Marks: _____/9

Name: _____ "Solution" _____ Section #: _____
ID #: _____ Serial #: _____

1. The average cost per unit is given by $\bar{c} = .01q + \frac{500}{q}$, where q is total number of units produced. Find the marginal-cost for 50 units.

$$C = \bar{c}q = .01q^2 + 500$$

$$\frac{dC}{dq} = .02q$$

$$\left. \frac{dC}{dq} \right|_{q=50} = (.02)(50)$$

$$= \frac{2}{100}(50)$$

$$= \frac{100}{100} = 1$$

2. If $g(x) = \frac{3\sqrt{x}}{x+4}$, then find $g'(1)$.

$$g'(x) = \frac{3}{(x+4)^2} \left[(x+4) \frac{1}{2\sqrt{x}} - \sqrt{x} (1) \right]$$

$$g'(1) = \frac{3}{(5)^2} \left[(5) \left(\frac{1}{2} \right) - 1 \right]$$

$$= \frac{3}{25} \left[\frac{5-2}{2} \right] = \frac{3}{25} \left(\frac{3}{2} \right) = \frac{9}{50}$$

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1. For $f(x) = \frac{x+3}{x^2+7}$, show that $f'(x) = \frac{(x+7)(1-x)}{(x^2+7)^2}$.

$$\begin{aligned} f'(x) &= \frac{(x^2+7)(1) - (x+3)(2x)}{(x^2+7)^2} \\ &= \frac{x^2+7 - 2x^2 - 6x}{(x^2+7)^2} \\ &= \frac{-(x^2+6x-7)}{(x^2+7)^2} = \frac{-(x-1)(x+7)}{(x^2+7)^2} \\ &= \frac{(1-x)(x+7)}{(x^2+7)^2} \end{aligned}$$

2. If $y = u^3 + u + 1$ and $u = \sqrt{x}$, then find $\left. \frac{dy}{dx} \right|_{x=1}$.

$y \rightarrow u \rightarrow x$

$$\frac{dy}{dx} = \frac{dy}{du} \frac{du}{dx}$$

$$= (3u^2 + 1) \left(\frac{1}{2\sqrt{x}} \right)$$

$$\left. \frac{dy}{dx} \right|_{x=1} = [3(1)^2 + 1] \left(\frac{1}{2\sqrt{1}} \right)$$

$$= \frac{4}{2} = 2$$

$$\begin{aligned} u &= x^{1/2} \Rightarrow \frac{du}{dx} = \frac{1}{2\sqrt{x}} \\ x=1 &\Rightarrow u = \sqrt{1} = 1 \\ &\Rightarrow u^2 = 1 \end{aligned}$$

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1. If $z = 4y^2 - 2y + 7$, $y = 2x - 1$ and $x = 3t$, then find $\frac{dz}{dt} \Big|_{t=1}$.

$$z \rightarrow y \rightarrow x \rightarrow t$$

$$t=1 \Rightarrow x = 3(1) = 3$$

$$\Rightarrow y = 2x - 1 = 2(3) - 1 = 5$$

$$\frac{dz}{dt} = \frac{dz}{dy} \frac{dy}{dx} \frac{dx}{dt}$$

$$= (8y - 2)(2)(3)$$

$$\left. \frac{dz}{dt} \right|_{t=1} = (8(5) - 2)(6) = (38)(6) = 228$$

2. If the demand equation for a manufacturer's product is $p = \frac{1000}{q+5}$, then find marginal-revenue for $q = 20$.

$$r = pq = \frac{1000q}{q+5}$$

$$\frac{dr}{dq} = \frac{(q+5)(1000) - (1000q)(1)}{(q+5)^2}$$

$$\left. \frac{dr}{dq} \right|_{q=20} = \frac{(25)(1000) - (1000)(20)}{(25)(25)} = \frac{5 \overset{40}{(1000)}}{25 \times 25} = \frac{200}{25} = 8$$