STEPs Math Quiz 3

Thursday, August 7, 2025 **Version 1**

Name: _____ National ID: _____

Select your section instructor: ☐ Majid ☐ Asaad

1. (6 points) A company produces sofas. The profit, in riyals, from selling x units is modeled by:

$$P(x) = -x^3 + 6x^2 + 15x + 20$$

Find the maximum profit and determine the value of x at which it occurs.

2. (15 points) Find the derivative of the following functions (find $f'(x)$ or $\frac{dy}{dx}$ for each relation):

(a) (1 point) $f(x) = 2x^5 - 3x^4 + 7x^2 + 1$

(b) (3 points) $f(x) = \frac{x^2+1}{x^2-1}$

(c) (4 points) $f(x) = (x+2)^2(x-5)^3$

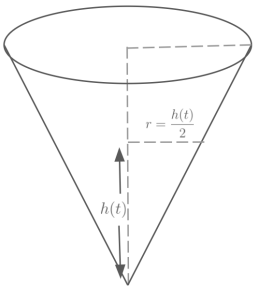
(d) (1 point) $f(x) = 3\sqrt{x} + 2e^x - 7\ln(x)$

(e) (3 points) $f(x) = \ln(\sqrt{4x^2+7})$

(f) (3 points) $f(x) = 3e^{x^2+2x+\sqrt{x}}$

3. (9 points) A conical container is being filled with water. The container has a height of 8 meters and a base radius of 4 meters. At time t, the water is $h(t)$ meters deep, and the radius is $r(t) = \frac{h(t)}{2}$. The height grows over time according to $h(t) = 2t^{\frac{1}{2}} + 3t^{\frac{1}{3}}$.

   (a) (2 points) The volume V of a cone is given by the expression $V = \frac{\pi}{3}r^2h$. Express the volume V of the water in the cone as a function of h only.



   (b) (5 points) Find $\frac{dV}{dt}$ in terms of t.

   (c) (2 points) How fast is the volume of water changing at $t = 1$ minute?

4. (3 points) Determine the values of m, n such that the following function is continuous for all real numbers:

$$f(x) = \begin{cases} -x^2 + nx + m, & x < 2 \\ 2x - m, & 2 \le x \le 4 \\ -x - n, & x > 4 \end{cases}$$

Sudoku Bonus (1pt)
(each row, column, and 2x3 box must contain 1-6)

				5	6
4			3	1	
		3			1
	1	2	6	4	
				6	
2					5

STEPs Math Quiz 3

Thursday, August 7, 2025 **Version 2**

Name: _____ National ID: _____

Select your section instructor: ☐ Majid ☐ Asaad

1. (6 points) A company produces bicycles. The profit, in riyals, from selling x units is modeled by:

$$P(x) = -x^3 + \frac{9}{2}x^2 + 12x + 12$$

Find the maximum profit and determine the value of x at which it occurs.

2. (15 points) Find the derivative of the following functions (find $f'(x)$ or $\frac{dy}{dx}$ for each relation):

(a) (1 point) $f(x) = 3x^5 - 2x^4 + 6x^2 + 5$

(b) (3 points) $f(x) = \frac{2x^2+1}{x^2-2}$

(c) (4 points) $f(x) = (x+3)^2(x-4)^3$

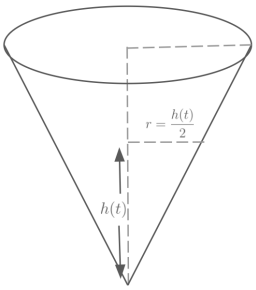
(d) (1 point) $f(x) = 4\sqrt{x} + 3e^x - 5\ln(x)$

(e) (3 points) $f(x) = \ln(\sqrt{3x^2+4})$

(f) (3 points) $f(x) = 3e^{x^3+3x+e^x}$

3. (9 points) A conical container is being filled with water. The container has a height of 8 meters and a base radius of 4 meters. At time t, the water is $h(t)$ meters deep, and the radius is $r(t) = \frac{h(t)}{2}$. The height grows over time according to $h(t) = 2t^{\frac{1}{2}} + 4t^{\frac{1}{4}}$.

   (a) (2 points) The volume V of a cone is given by the expression $V = \frac{\pi}{3}r^2h$. Express the volume V of the water in the cone as a function of h only.



   (b) (5 points) Find $\frac{dV}{dt}$ in terms of t.

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4. (3 points) Determine the values of m, n such that the following function is continuous for all real numbers:

$$f(x) = \begin{cases} -x^2 + nx + m, & x < 2 \\ 2x - m, & 2 \le x \le 4 \\ -x - n, & x > 4 \end{cases}$$

Sudoku Bonus (1pt)
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				3	
	5		1	4	
	3				
		4	3		
5	1		4		
	6			5	

STEPs Math Quiz 3

Thursday, August 7, 2025 **Version 3**

Name: _____ National ID: _____

Select your section instructor: ☐ Majid ☐ Asaad

1. (6 points) A company produces trucks. The profit, in riyals, from selling x units is modeled by:

$$P(x) = -x^3 + 3x^2 + 9x + 17$$

Find the maximum profit and determine the value of x at which it occurs.

2. (15 points) Find the derivative of the following functions (find $f'(x)$ or $\frac{dy}{dx}$ for each relation):

(a) (1 point) $f(x) = 2x^6 - 5x^3 + x^2 + 15$

(b) (3 points) $f(x) = \frac{x^2+3}{2x^2-1}$

(c) (4 points) $f(x) = (x+1)^2(x-6)^3$

(d) (1 point) $f(x) = 6\sqrt{x} + \frac{1}{2}e^x - 3\ln(x)$

(e) (3 points) $f(x) = \ln(\sqrt{9x^2+7})$

(f) (3 points) $f(x) = 2e^{2x^3+x+\ln x}$

3. (9 points) A conical container is being filled with water. The container has a height of 8 meters and a base radius of 4 meters. At time t, the water is $h(t)$ meters deep, and the radius is $r(t) = \frac{h(t)}{2}$. The height grows over time according to $h(t) = 3t^{\frac{1}{3}} + 4t^{\frac{1}{4}}$.

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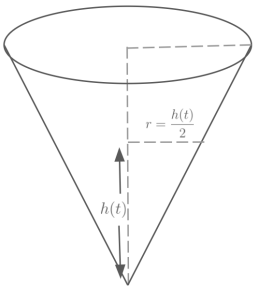

   (b) (5 points) Find $\frac{dV}{dt}$ in terms of t.

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4. (3 points) Determine the values of m, n such that the following function is continuous for all real numbers:

$$f(x) = \begin{cases} -x^2 + nx + m, & x < 2 \\ 2x - m, & 2 \le x \le 4 \\ -x - n, & x > 4 \end{cases}$$

Sudoku Bonus (1pt)
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	3		4		
			5	2	
			2		
	5	1			
6		5			
	1	4			2