

Name \_\_\_\_\_ Q1 Test 3 Review Sheet

- Write the equations of the tangent line to the curve  $f(x) = -\sin(x)$  when  $x = \pi$ .
- Given  $h(x) = (3x^3 - x^2 + 10x + 2)\cos(x)$ , find  $h'(x)$ .
- Find the derivative of the following function in simplest form:  $y = \frac{3x^2 - 2}{2x - 3}$

For questions 4 - 7 use the following table to find  $y'$  at  $x = 1$ , if:

$f(1)$	$f'(1)$	$g(1)$	$g'(1)$
3	4	1	-2

- $y = f(x)g(x)$
- $y = \frac{f(x)}{g(x)}$
- $y = x^4 g(x)$
- $y = \frac{x^3 - 2x}{g(x)}$

- Find the coordinates of the point(s) where  $f(x) = \frac{1}{4}x^4 - \frac{1}{3}x^3 - x^2$  has horizontal tangents.
- Find the equation of the tangent line to the curve,  $f(x) = \frac{1}{4}x^4 - \frac{1}{3}x^3 - x^2$  when  $x = -2$
- Find  $f'(x)$  if  $f(x) = \frac{3x^2}{x-1}$
- Find  $f'(x)$  if  $f(x) = 3x^2 \sin x$

Find the derivative of each of the following:

- $f(x) = 5x + 2\sqrt{x} - \frac{3}{x^2}$
- $f(x) = \sin(3x+1)$
- $f(x) = \sqrt[3]{(x^2+5x)^3}$
- $y = \ln x^5$
- $y = e^{4x^2+2}$
- $y = x^5 - \ln(x) + 5e^2$

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3	4	1	-2

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- $y = \frac{f(x)}{g(x)}$
- $y = x^4 g(x)$
- $y = \frac{x^3 - 2x}{g(x)}$

④  $y' = f(x)g'(x) + g(x)f'(x)$   
 $= f(1)g'(1) + g(1)f'(1)$   
 $= 3(-2) + 1(4) = -6 + 4 = -2$

⑤  $y' = \frac{g(1)f'(1) - f(1)g'(1)}{(g(1))^2} \rightarrow \frac{(1)(4) - (3)(-2)}{(1)^2}$

⑥  $y' = x^4 g'(1) + g(1)(4x^3)$   $\frac{4+6}{1} \rightarrow 10$   
 $y' = 1^4(-2) + (1)(4(1)^3)$   
 $= -2 + 4 = 2$

⑦  $y = \frac{x^3 - 2x}{g(x)}$   
 $y' = \frac{g(1)(3x^2 - 2) - (x^3 - 2x)g'(1)}{(g(1))^2}$   
 $= \frac{1(3(1)^2 - 2) - (1^3 - 2(1))(-2)}{(1)^2}$   
 $= \frac{1 + 2(-1)}{1} = -1$

$$\textcircled{1} f(x) = -\sin x \quad x = \pi$$

$$f(\pi) = -\sin \pi = 0 \quad (\pi, 0)$$

$$f'(x) = -\cos x$$

$$f'(\pi) = -\cos \pi = 1$$

$$y - y_1 = m(x - x_1)$$

$$y - 0 = 1(x - \pi)$$

$$y = x - \pi$$

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$$\textcircled{2} h(x) = (3x^3 - x^2 + 10x + 2)(\cos(x))$$

$$h'(x) = (3x^3 - x^2 + 10x + 2)(-\sin(x)) + (\cos(x))(9x^2 - 2x + 10)$$

$$\textcircled{3} y = \frac{3x^2 - 2}{2x - 3}$$

$$y' = \frac{(2x - 3)(6x) - (3x^2 - 2)(2)}{(2x - 3)^2}$$

$$y' = \frac{12x^2 - 18x - 6x^2 + 4}{(2x - 3)^2} \rightarrow \frac{6x^2 - 18x + 4}{(2x - 3)^2}$$

$$\begin{aligned}
 12. \quad f(x) &= 5x + 2\sqrt{x} - \frac{3}{x^2} \\
 f(x) &= 5x + 2x^{\frac{1}{2}} - 3x^{-2} \\
 f'(x) &= 5 + \frac{2}{3}x^{-\frac{1}{2}} + 6x^{-3} \\
 f'(x) &= 5 + \frac{2}{3\sqrt{x}} + \frac{6}{x^3} \\
 13. \quad f(x) &= \sin(3x+1) \\
 f'(x) &= \cos(3x+1)(3) \\
 &= 3\cos(3x+1) \\
 14. \quad f(x) &= \sqrt[4]{(x^2+5x)^3} \\
 f(x) &= (x^2+5x)^{-\frac{1}{4}}(2x+5) \\
 f'(x) &= \frac{3}{4}(x^2+5x)^{-\frac{5}{4}}(2x+5) \\
 &= \frac{3(2x+5)}{4\sqrt[4]{(x^2+5x)^5}}
 \end{aligned}$$

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$$\begin{aligned}
 15. \quad y &= \ln x^5 \\
 y' &= \frac{5x^4}{x^5} \rightarrow \frac{5}{x} \\
 16. \quad y &= e^{4x^3+2} \\
 \frac{dy}{dx} &= e^{4x^3+2} \cdot 12x^2 \\
 &= 12x^2 e^{4x^3+2} \\
 17. \quad y &= x^5 \ln(x) + 5e^2 \text{ constant} \\
 y' &= 5x^4 - \frac{1}{x}
 \end{aligned}$$

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$$\textcircled{8} \quad f(x) = \frac{1}{4}x^4 - \frac{1}{3}x^3 - x^2$$

$$f'(x) = 0$$

$$f'(x) = x^3 - x^2 - 2x$$

$$0 = x^3 - x^2 - 2x$$

$$0 = x(x^2 - x - 2)$$

$$= x(x-2)(x+1)$$

$x=0$	$x=2$	$x=-1$
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$(0, 0)$   
 $(2, -8/3)$   
 $(-1, -5/12)$

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$$\textcircled{9} \quad f(x) = \frac{1}{4}x^4 - \frac{1}{3}x^3 - x^2 \quad x=-2$$

$$f(-2) = 8/3 \quad (-2, 8/3)$$

$$f'(-2) = -8 - 4 + 4$$

$$= -8$$

$$y - 8/3 = -8(x+2)$$

$$\textcircled{10} \quad f(x) = \frac{3x^2}{x-1}$$

$$f'(x) = \frac{(x-1)(6x) - 3x^2(1)}{(x-1)^2}$$

$$= \frac{3x^2 - 6x}{x^2 - 2x + 1}$$

$$\textcircled{11} \quad f(x) = 3x^2 \sin(x)$$

$$f'(x) = 3x^2(\cos(x)) + (\sin(x))(6x)$$

$$= (3x^2)(\cos(x)) + (6x)(\sin(x))$$

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