AP Calculus BC '19-20 Name_____
Dr. Quattrin
Derivative Test

1.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	2	3	4	-1
2	4	-1	7	8
4	1	2	2	1

Selected values of f, g, and their derivatives are indicated in the table above. Let $h(x) = g\left(f\left(x^2\right)\right)$. What is the value of $h'(2)$?

a) -8 b) -4 c) 1 d) 2 e) 16

---

2. Differentiate $y = x^2 \tan^{-1}\left(\frac{1}{x}\right)$

a) $\dfrac{2x}{1+x^2}$

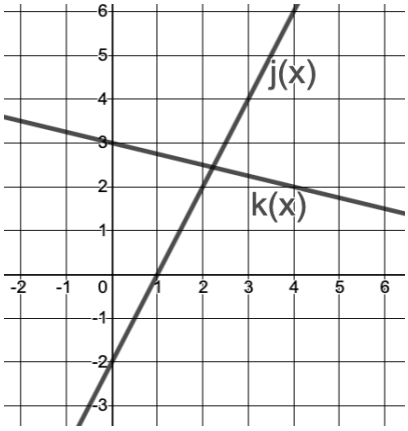
b) $\dfrac{2\tan^{-1}\dfrac{1}{x}}{x}$

c) $\dfrac{x^2}{x^2+1} - 2x\tan^{-1}\dfrac{1}{x}$

d) $\dfrac{-x^2}{x^2+1} + 2x\tan^{-1}\dfrac{1}{x}$

e) $\dfrac{-1}{x^2+1} + 2x\tan^{-1}\dfrac{1}{x}$

3. The graphs of linear functions $j(x)$ and $k(x)$ are shown below. Let $f(x) = j(x) \cdot k(x)$. What is the equation of the line tangent to $f(x)$ at $x = 0$?



a) $y = \frac{11}{2}x - 6$ b) $y = -\frac{1}{2}x - 6$ c) $y = \frac{13}{2}x - 6$

d) $y = \frac{7}{4}x + 6$ e) $y = -\frac{2}{3}x + 6$

---

4. The derivative of the function $g(x)$ is given by $\frac{dy}{dx} = xy$. Using Euler's Method with 3 steps of equal size, starting at the point $(2,1)$, $g(5) \approx$

a) 3 b) 6 c) 7 d) 60 e) 63

5. Find the slope of the line **normal** to the curve $\sqrt{x} - \cos y = x$ at the point $\left(1, \frac{\pi}{2}\right)$

a) -2 b) $-1/2$ c) $1/2$ d) 2 e) DNE

---

6. Find the approximate value of $\sqrt[3]{7}$ using the tangent approximation for $\sqrt[3]{x}$ at $x = 8$.

a) $\frac{25}{12}$ b) $\frac{23}{12}$ c) $\frac{15}{8}$ d) $\frac{7}{4}$ e) $\frac{13}{8}$

FREE RESPONSE – show all work in a clear, organized manner. Simplify answers.

7a. $\frac{d}{dx}\left(\cos^{-1} 4x^2\right)$

b. $\frac{d}{dx}\left(\ln\left(x^2+2x-8\right)\right)$

c. $\frac{d}{dx}\left(e^{-\frac{1}{2}x}\csc x\right)$

d. $\frac{d}{dx}\left(\frac{-5x}{25+x^2}\right)$

8. If $f(x) = \tan^2(3x)$, find $f'(x)$ and $f''(x)$. Write answers in simplified, factored form.

9. Find the second derivative of $y = \ln(\pi \sin x)$. Simplify your answer.

10. Consider the function $y^3 - 2xy = 1 - x^2$.

a) Show that $\frac{dy}{dx} = \frac{-2x + 2y}{3y^2 - 2x}$

b) Find the approximate value of $f(-1.2)$, using the linear approximation at $(-1,0)$

c) Find $\frac{d^2y}{dx^2}$ at $(-1,0)$.

d) Is your approximation from part (b) higher or lower than the actual value of $f(-1.2)$? Justify your response.