Name: _____

Please read each question carefully to ensure that you are actually answering it. **Show all work.** All numerical answers should be left in **exact** form unless otherwise specified.

Page:	1	2	3	4	5	6	Total
Points:	14	18	18	18	14	18	100
Score:							

8 1. (a) Find $\dfrac{dy}{dx}$ by implicit differentiation. $2y + \sin x - 2 = x^4 - xy.$

6 (b) Find an **equation of the tangent line** to the curve

$$2y + \sin x - 2 = x^4 - xy \qquad \text{at the point } (0, 1),$$

in the slope-intercept ($y = mx + b$) form. (Note that it is the same curve in part (a) above.)

[12] 2. Find the derivatives of the following functions. You do not need to simplify your answer.

(a) $f(x) = e^{5x} + x^5 + 5^x$

(b) $f(x) = \ln(x \tan x)$

(c) $f(x) = \left(\dfrac{x^3 + 2x}{5x^2 - 3}\right)^7$

[6] 3. An object is launched vertically up on Planet X. The position, $s(t)$ (in feet), of the object after t seconds is given by

$$s(t) = 42t - 6t^2$$

What is the maximum height reached by the object?

[10] 4. Find the linearization $L(x)$ of the function $f(x) = \sqrt[3]{x}$ at the number 27, and use it to approximate the value of $\sqrt[3]{28}$.

5. Consider the function $f(x) = 5x^{\frac{1}{3}} - x^{\frac{5}{3}}$. Answer the following using **calculus**.

[6] (a) Find the intervals on which f is increasing or decreasing.

f is increasing on ..... *f is decreasing on* .....

[2] (b) Find the $x-$values where f attains its local maximum and minimum values.

f has local maximum at $x =$ ..... *f has local minimum at $x =$* .....

[8] 6. Note that the function $f(x) = 3x^2 + 2x + 5$ is continuous on $[-1, 2]$ and differentiable on $(-1, 2)$ being a polynomial. Find all number(s) $\mathbf{c}$ in $(-1, 2)$ satisfying the conclusion of the Mean Value Theorem for the function f.

[10] 7. A girl flies a kite at a height of 600 ft, the wind carrying the kite horizontally away from her at a rate of 12 ft/sec. How fast must she let out the string when the kite is 1000 ft away from her? Assume the string is taut so that it forms a straight line.

10 8. Find the absolute maximum and absolute minimum **values** of the function

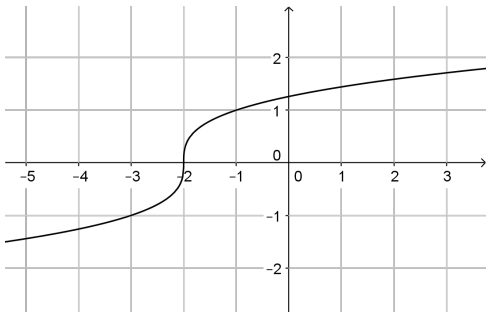
$$f(x) = x^3 - 3x^2 + 60$$

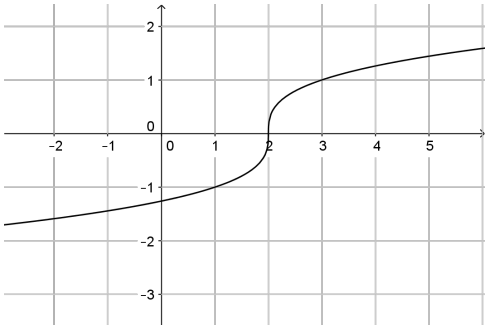
in the interval $[-3, 1]$. **Write your answer in the space provided.**

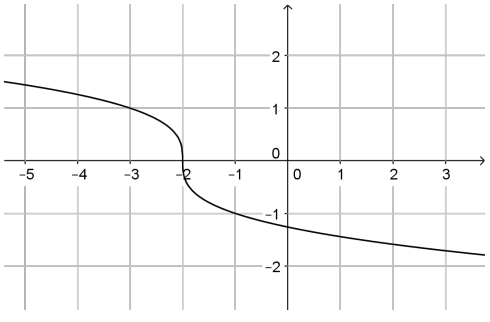
Absolute max. value: . . . . . *Absolute min. value:* . . . . . .

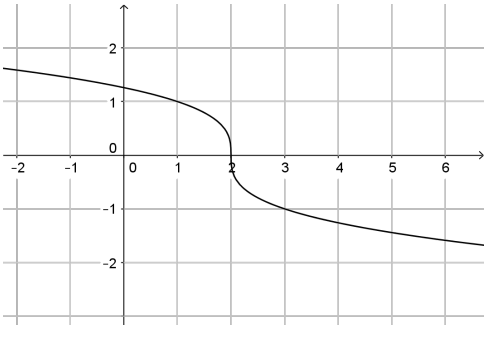
4 9. Choose a graph of the function f that is continuous on $(-\infty, \infty)$ and has the following properties.

$$f'(x) < 0 \text{ and } f''(x) < 0 \text{ on } (-\infty, 2); \quad f'(x) < 0 \text{ and } f''(x) > 0 \text{ on } (2, \infty)$$









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6 10. Find the **slope** of the tangent line to the curve

$$\tan(xy) = y \qquad \text{at the point} \qquad \left(\frac{\pi}{4}, 1\right).$$

Circle the correct answer. You do not need to show your work. (No partial credit will be given.)

3 11. If $f(x) = \cos^2 x$, its derivative, $f'(x)$, is given by

(a) $\dfrac{\cos^3 x}{3}$ (b) $-\dfrac{\sin^3 x}{3}$ (c) $-\sin^2 x$ (d) $-2\cos x \sin x$ (e) $2\sin x \cos x$

3 12. The derivative of $y(x) = 3\log_3(x)$ is given by

(a) $\dfrac{3}{x}$ (b) $\dfrac{1}{x}$ (c) $\dfrac{1}{x\ln 3}$ (d) $\dfrac{3}{x\ln 3}$ (e) $\dfrac{3}{\ln 3}$

Use the table for the following two questions.

x	f	f'	g	g'
0	2	-2	2	-1
1	3	10	2	10
2	2	-3	-2	4

3 13. If $H(x) = f(g(x)) + 4$, find $H'(0)$.

(a) 2 (b) 4 (c) 5 (d) 3 (e) -2

3 14. If $J(x) = \tan^{-1}(g(x))$, find $J'(1)$.

(a) 0 (b) 1 (c) 10 (d) 2 (e) $\dfrac{1}{10}$