Honors Precalc '23 (Quattrin) Name:____________________

Spring Final – Part I; 30 Minutes

Calculator Allowed score _____

1. Which of the following statements must be **false**?

(A) $\dfrac{d}{dx}\left(x^3+4x^2-\sqrt[3]{x^2}-\dfrac{1}{7x}\right)=3x^2+8x-\dfrac{3}{2}x^{1/2}+\dfrac{1}{7x^2}$

(B) $\dfrac{d}{dx}\ln\left(1-x^3\right)=\dfrac{-3x^2}{1-x^3}$

(C) $\dfrac{d}{dx}(x\tan x)=\tan x+x\sec^2 x$

(D) $\dfrac{d}{dx}e^{\csc x}=e^{\csc x}\csc^2 x$

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2. A particle is moving along the $x$-axis in such a way that its velocity at time $t > 0$ is given by $v(t) = \frac{\ln t}{t}$. At what value of $t$ does $v$ attain its maximum?

(A) 1 (B) $e^{1/2}$ (C) $e$ (D) $e^{3/2}$

(E) There is no maximum value of $v$.

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3. Given the functions $f(x)$ and $g(x)$ that are both continuous and differentiable, and that have values given on the table below, find $h'(4)$, given that $h(x) = f\left(\frac{1}{2}x\right) \cdot g(2x)$.

| $x$ | $f(x)$ | $f'(x)$ | $g(x)$ | $g'(x)$ |
|---|---|---|---|---|
| 2 | 4 | -2 | 8 | 1 |
| 4 | 10 | 8 | 4 | 3 |
| 8 | 6 | -12 | 2 | 4 |

(A) 12 (B) 30 (C) -8 (D) 62 (E) 76

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4. The equation of the line tangent to the graph of $y = \dfrac{x-4}{1-2x}$ at the point $(0, f(0))$ is

(A) $7x + y = -4$ (B) $7x - y = 4$ (C) $x - 7y = 28$

(D) $x - 7y = 12$ (E) $x + 7y = -28$

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5. Which of these functions has a point of exclusion at $(1,3)$ and a vertical asymptote at $x = \dfrac{1}{2}$?

(A) $g(x) = \dfrac{x-1}{4x^2-1}$ (B) $h(x) = \dfrac{x-1}{2x^2-3x+1}$

(C) $f(x) = \dfrac{2x+1}{4x^2-1}$ (D) $k(x) = \dfrac{3x-3}{2x^2-3x+1}$

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6. What is the slope of the line tangent to the curve $y^2 + x = -2xy - 5$ at the point (2,1)?

(A) $-\dfrac{4}{3}$ (B) $-\dfrac{3}{4}$ (C) $-\dfrac{1}{2}$ (D) $-\dfrac{1}{4}$ (E) 0

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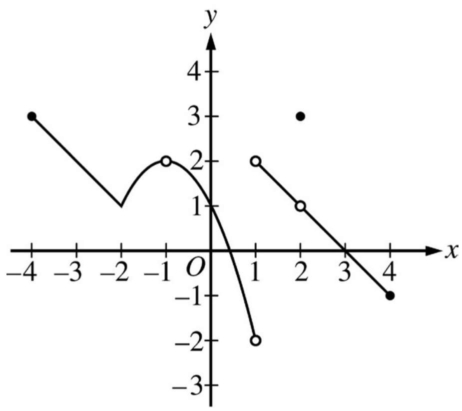
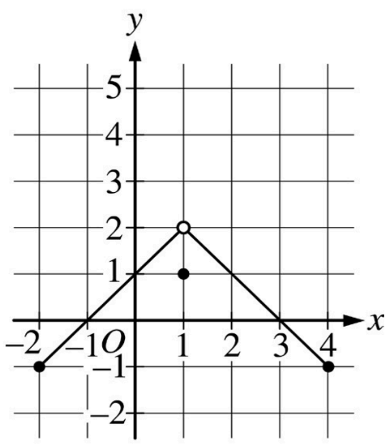



Graph of $f$




Graph of $g$

7. The graphs of the functions $f$ and $g$ are shown above. If $h(x) = g(f(x))$, then $h'(3) =$

(A) $-1$ (B) 0 (C) 1 (D) 3 (E) dne

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8. At what approximate rate (in cubic meters per minute) is the volume of a cube changing at the instant when the surface area is 54 square meters and each edge is increasing at the rate of 3 meters per minute?

(A) 9 (B) 27 (C) 54 (D) 81 (E) d162ne

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9. $$\lim_{x \to \infty} \frac{2 + \ln(3x)}{5 + \ln(2x^2)} =$$

(A) $0$ (B) $\frac{2}{5}$ (C) $\frac{1}{2}$ (D) $\frac{3}{2}$ (E) $\infty$

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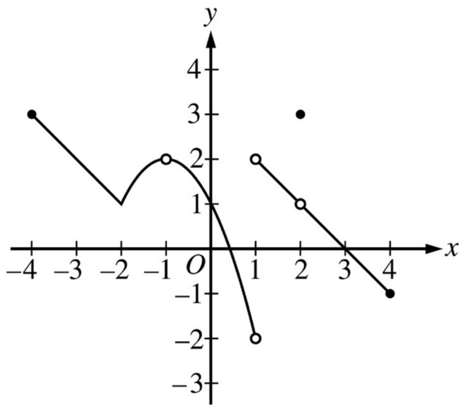
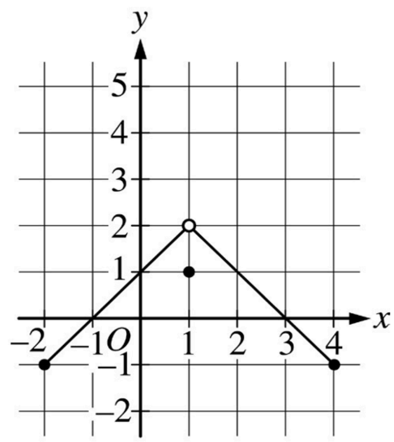



Graph of $f$

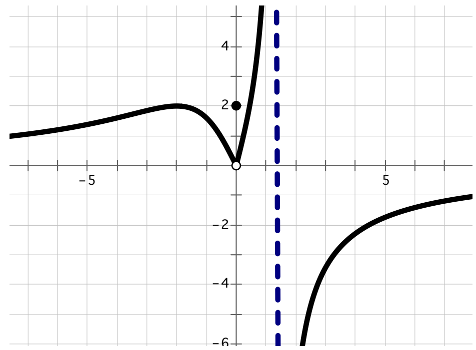



Graph of $g$

10. The graphs of the functions $f$ and $g$ are shown above. The value of

$$\lim_{x \to 2} g(f(x)) =$$

(A) 0 (B) 1 (C) 2 (D) -2 (E) dne




11. Given the graph of $f(x)$ above, the reason that $f(x)$ is not continuous at $x = 0$ is because

(A) $f(0)$ does not exist

(B) $\lim_{x \to 0^-} f(x) \neq \lim_{x \to 0^+} f(x)$

(C) $\lim_{x \to 0} f(x) \neq f(0)$

(D) $\lim_{x \to 0} f(x)$ does not exist

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12. If $y = x^2 e^{2x}$, then $\frac{dy}{dx} =$

a) $2xe^{2x}$ b) $4xe^{2x}$ c) $xe^{2x}(x+1)$

d) $2xe^{2x}(x+1)$ e) $xe^{2x}(x+2)$

13. Let $f$ be the function defined below, where $a$ and $b$ are constants. If $f$ is differentiable at $x = 1$, what are the values of $a$ and $b$?

$$f(x) = \begin{cases} ax^3 - x, \text{ if } x \le 1 \\ bx^2 + 5, \text{ if } x > 1 \end{cases}$$

(A) $a = -7,\ b = -11$

(B) $a = -11,\ b = -17$

(C) $a = -17,\ b = -11$

(D) $a = -11,\ b = -7$

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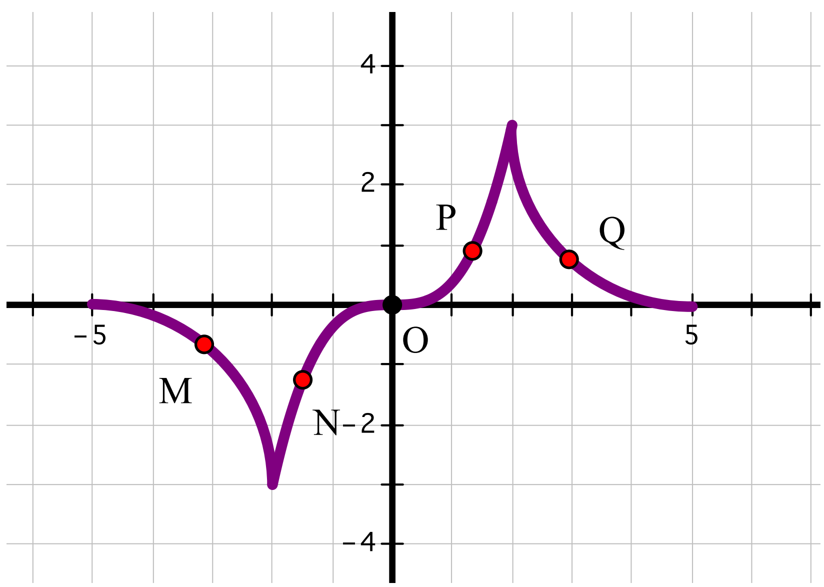


14. At what point on the above curve is $\frac{dy}{dx} > 0$ and $\frac{d^2y}{dx^2} > 0$

a) M b) N c) P d) Q

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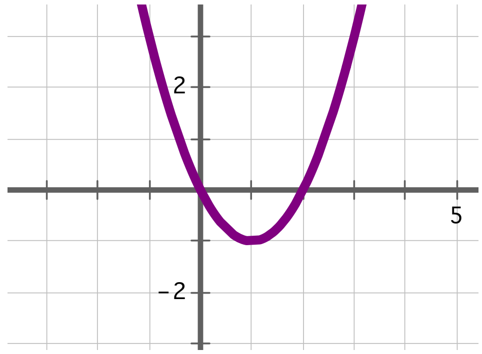
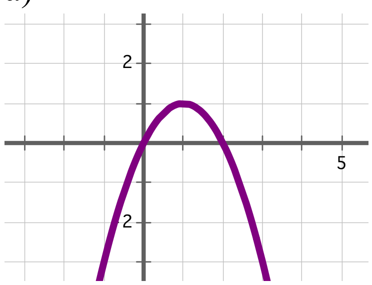
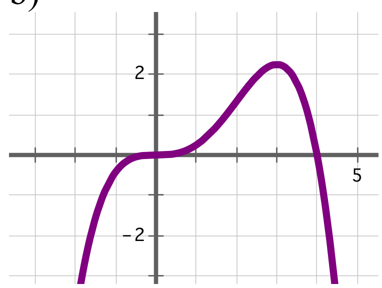



15. The function $h'(x)$ is graphed above. Which of these functions represents $h(x)$?

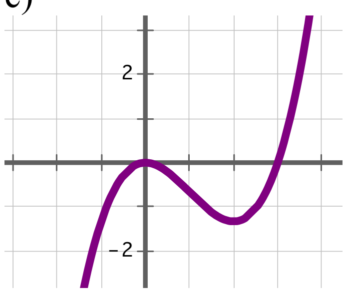
a)



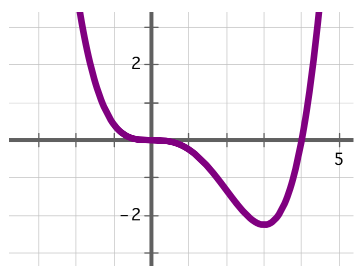

b)



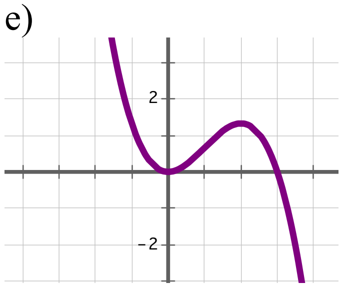

c)




d)




e)



Honors Precalc ‘23 Name:______________________
Spring Final – Part IIA; 60 Minutes
Dr. Quattrin
Calculator Allowed score ______

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

1b. $\frac{d}{dx}\left(\sqrt{3x}\ cot\ 6x\right)$

1c. $\frac{d}{dx}\left(\sqrt{\tan\left(1-x^2\right)}\right) =$

1d. $\frac{d}{dx}\left(sec^{-1}\left(e^{5x}\right)\right) =$

2. Find the domain and Zeros of $f(x) = \dfrac{x^2 + 2x - 3}{3x^3 + 16x^2 + 21x}$. Show the supporting algebraic work.

Domain: ____________________

Zeros: ____________________

3. Find the extreme points of $f(x) = \dfrac{x^2 + 2x - 3}{3x^3 + 16x^2 + 21x}$. Show the algebraic work to support the critical values.

Extreme Points: ____________________________________

4. Find the domain and Zeros of $g(x)=(4-x)\sqrt{6x-x^2}$. Show the supporting algebraic work.

Domain: ____________________

Zeros: _____________________

5. Find the extreme points of $g(x)=(4-x)\sqrt{6x-x^2}$. Show the algebraic work to support the critical values.

Extreme Points: ____________________________________

6. Find the domain, VAs, and Zeros of $f(x) = \ln(-x^3 - 3x^2 + 4x)$ on $x \in [-6, 2]$. Show the sign pattern to support the domain.

Domain: ____________________

VAs: ____________________

Zeros: _____________________

7. Find the extreme points of $f(x) = \ln(-x^3 - 3x^2 + 4x)$ on $x \in [-6, 2]$. Show the algebraic work to support the critical values.

Extreme Points: _____________________________________

8. Using the functions from #1 and #2, find the traits and sketch

$$K(x) = \begin{cases} f(x) & \text{if } x < 0 \\ g(x) & \text{if } x \geq 0 \end{cases}$$

Domain:

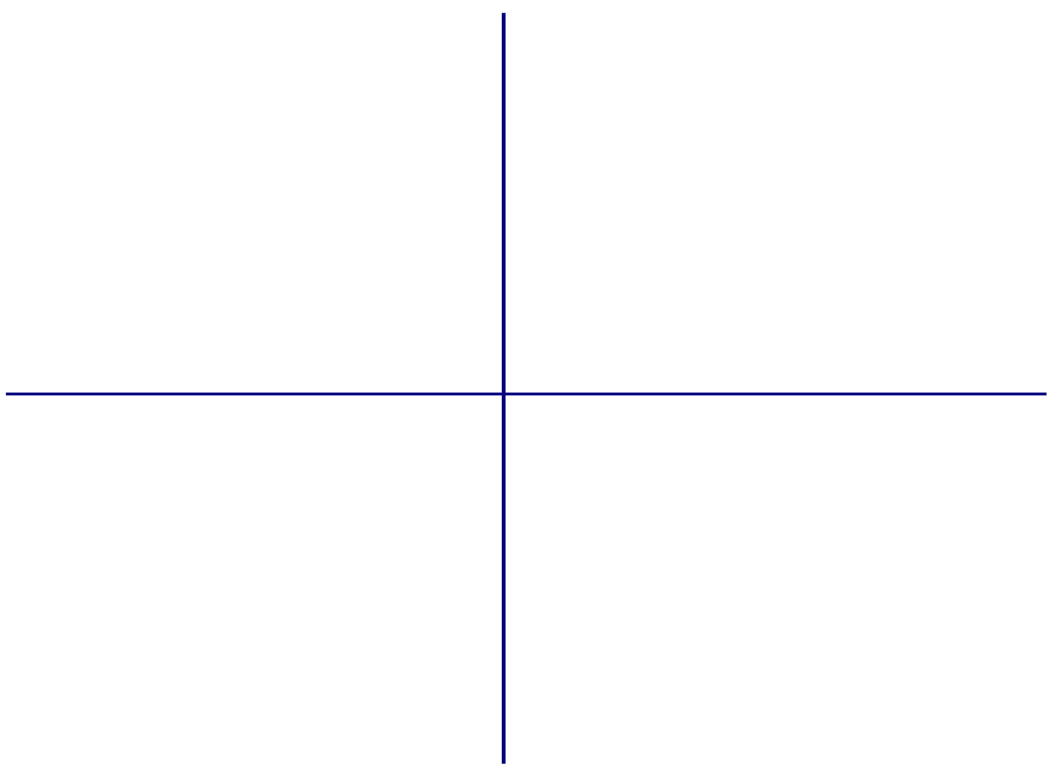
Domain: Range:

Zeros: $y$ - intercept:

VAs: POEs:

EB (Left): EB (Right):

Extremes:



9. Find the traits and sketch of $f(x) = \ln\left(-x^3 - 3x^2 + 4x\right)$ on $x \in [-6, 2]$.

Domain:

Range:

Zeros:

$y$ - intercept:

VAs:

POEs:

EB (Left):

EB (Right):

Extremes: