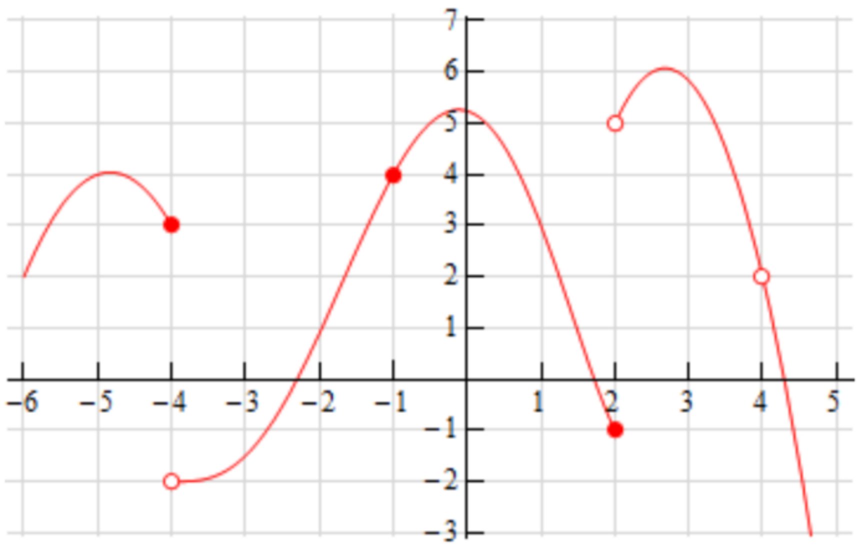
	VS A	VS B
1	D	D
2	C	D
3	D	C
4	D	B
5	B	C
6	A	D
7	C	B
8	A	B
9	D	B
10	D	B
11	D	D
12	A	D
13	B	A

Multiple Questions are worth 4 points each.

Use the graph of $f(x)$ below to answer questions 1–3



1. Find $\lim_{x \to -4^+} f(x)$

   A. 0 B. −1 C. 4 D. −2 E. DNE

---

2. How many discontinuities does $f(x)$ have?

   A. 0 B. 1 C. 2 D. 3 E. 4

---

3. Find $\lim_{x \to 4} f(x)$

   A. 0 B. 3 C. 2 D. 1 E. DNE

---

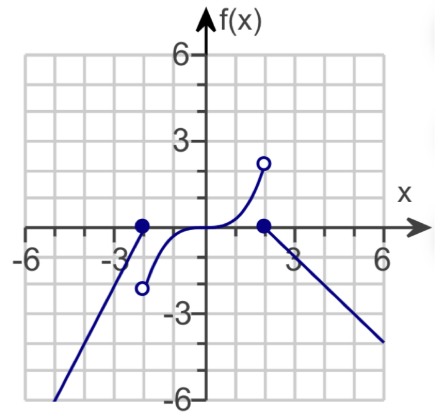
4. If $f(2) = 3$ and $f'(2) = -1$, what is the equation of the line tangent to the graph of $y = f(x)$ at $x = 2$.

   A. $y = -x + 2$ B. $y = 5 - x$ C. $y = 3x - 1$

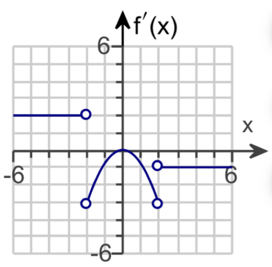
   D. $y = 3x + 2$ E. $y = 3 - x$

---

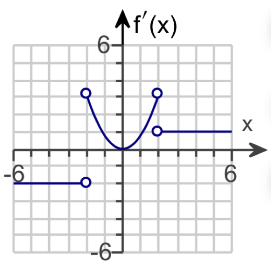
5. Match the graph of $f(x)$ with it's derivative $f'(x)$



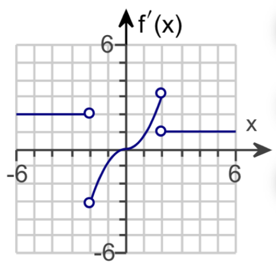
A.



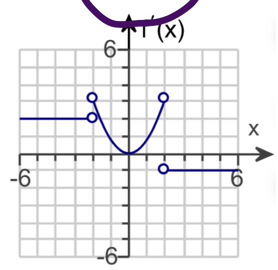
B.



C.



D.



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6. Calculate the limit

$$\lim_{x\to 4} \frac{-x^2+6x-8}{x-4}$$

A. B. 2 C. -2 D. 2 E. 4

2 DNE

---

7. Let

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

$g(4)=2$ $g'(4)=1$ $g(2)=-2$ $g'(2)=5$

Let $h(x)=(f\circ g)(2x)$. Find $h'(2)$

A. 2 B. 6 C. -8 D. 3 E. 0

---

8. Which of the following functions have a root between -1 and 2?

i. $f(x) = x^2 + 1$

ii. $g(x) = e^x - 1$

iii. $k(x) = x^2 + x + 2$

A. i only B. ii only C. i and iii

D. all of the above E. none of the above

---

9. Let

$$f'(2) = 3 \qquad f(2) = 4 \qquad f(4) = -1 \qquad f'(4) = -4$$
$$g(4) = 2 \qquad g'(4) = 1 \qquad g(2) = -2 \qquad g'(2) = 5$$

Let $p(x) = \dfrac{x^2 f(x)}{g(x)}$. Find $p'(2)$

A. 6 B. -34 C. -8 D. $\dfrac{5}{4}$ E. $-\dfrac{5}{4}$

---

10. What value of k will make $f(x)$ continous from $(-\infty, \infty)$?

$$f(x) = \begin{cases} 7x - 2 & x \leq 1 \\ kx^2 & x > 1 \end{cases}$$

A. -2 B. 5 C. 0 D. 7 E. 0

---

11. What is the value of the following limit: $\displaystyle\lim_{x\to\infty} \frac{x^2 - 6x + 3}{x + 2x^2 + 7}$?

A. 1 B. 0 C. ∞ D. $\dfrac{1}{2}$ E. DNE

---

12. State the equations of all horizontal asymptotes for a function $f(x)$ satisfying the following conditions.
$f(0) = 0$, $\lim_{x\to\infty} f(x) = 2$, $\lim_{x\to-\infty} f(x) = \infty$, $\lim_{x\to 3^-} f(x) = -\infty$, $\lim_{x\to 3^+} f(x) = \infty$, $\lim_{x\to -5} f(x) = -\infty$

A. $x = 3$ and $x = -5$
B. $y = 3$ and $y = -5$
C. $x = 2$ and $y = 3$
D. $y = 2$
E. $y = 0$

---

13. Let f be the piecewise function defined below. Which of the following statements about f are true.

$$f(x) = \begin{cases} \dfrac{x^2-4}{x-2} & \text{if } x \neq 2 \\ 1 & \text{if } x = 2 \end{cases}$$

I. $\lim_{x\to 2} f(x)$ exists

II. $f(x)$ is continous at $x = 2$

III. $f(x)$ is differentiable at $x = 2$

A. I only
B. I and II
C. I and III
D. All of the Above
E. None of the Above

Section # ______________ Name ______________________________

UF ID # ______________ Signature ______________________________

YOU MUST SHOW ALL WORK TO RECEIVE FULL CREDIT.

1. Let $f(x) = \sqrt{2+3x}$. Use the **limit definition of the derivative** to find $f'(1)$. (NOTE: No credit will be given if another method is used.)

$$\lim_{h\to 0} \frac{\sqrt{2+3(x+h)} - \sqrt{2+3x}}{h} \cdot \frac{\sqrt{2+3x+3h} + \sqrt{2+3x}}{\sqrt{2+3x+3h} + \sqrt{2+3x}}$$

$$= \lim_{h\to 0} \frac{\cancel{2}+\cancel{3x}+3h-(\cancel{2}+\cancel{3x})}{h(\sqrt{2+3x+3h}+\sqrt{2+3x})}$$

$$= \lim_{h\to 0} \frac{3\cancel{h}}{\cancel{h}(\sqrt{2+3x+3h}+\sqrt{2+3x})}$$

$$= \lim_{h\to 0} \frac{3}{\sqrt{2+3x+3h}+\sqrt{2+3x}}$$

$$= \frac{3}{2\sqrt{2+3x}} = f'(x) \qquad f'(1) = \frac{3}{2\sqrt{5}}$$

$$\lim_{x\to 1} \frac{\sqrt{2+3x} - \sqrt{5}}{x-1} \cdot \frac{\sqrt{2+3x} + \sqrt{5}}{\sqrt{2+3x} + \sqrt{5}}$$

$$= \lim_{x\to 1} \frac{2+3x-5}{(x-1)(\sqrt{2+3x}+\sqrt{5})}$$

$$= \lim_{x\to 1} \frac{3x-3}{(x-1)(\sqrt{2+3x}+\sqrt{5})}$$

$$= \lim_{x\to 1} \frac{3\cancel{(x-1)}}{\cancel{(x-1)}(\sqrt{2+3x}+\sqrt{5})}$$

$$= \frac{3}{\sqrt{5}+\sqrt{5}}$$

$$= \frac{3}{2\sqrt{5}}$$

2. Let $f(x) = \dfrac{x^2+3x-1}{x-2}$

(a) Find $f'(x)$

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

$$= \frac{2x^2-4x+3x-6-x^2-3x+1}{(x-2)^2}$$

$$= \frac{x^2-4x-5}{(x-2)^2}$$

(b) Find the equation of the tangent line to $f(x)$ at $x=3$

$$f'(3) = \frac{3^2-4(3)-5}{1} = -8 \qquad f(3) = \frac{9+9-1}{1} = 17$$

3. Let $f(x) = \sqrt{x^2-4x+13}$.

(a) At which x values does $f(x)$ have horizontal tangent lines?

$$f'(x) = \tfrac{1}{2}(x^2-4x+13)^{-\frac{1}{2}}(2x-4)$$

$$0 = \frac{2x-4}{2(x^2-4x+13)^{\frac{1}{2}}} \qquad \begin{aligned} 2x &= 4 \\ x &= 2 \end{aligned}$$

(b) Write the equation of the horizontal tangent line(s).

$$f(2) = \sqrt{2^2-4(2)+13} = 3 \qquad y = 3$$

4. Consider the function

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

(a) List each value of x at which $f(x)$ is discontinous, and describe each as removable, jump or infinite discontinuity.

$x=0$ removable

$x=2$ nonremovable (infinite)

(b) List all of the vertical and horizontal asymptotes. You **MUST** support your answers with limits.

$$\lim_{x\to\infty} \frac{3+x}{x-2} = 1 \Rightarrow \text{horizontal asymptote } y=1$$

$$\lim_{x\to 2^-} \frac{3+x}{x-2} = -\infty$$

$\Rightarrow$ vertical asymptote $x=2$

$$\lim_{x\to 2^+} \frac{3+x}{x-2} = \infty$$