Practice Test / Unit 5 KEY **Secondary 3 Honors**

Non-Calculator

Find the following limits. Work must be shown on all problems with ***proper limit notation***, where appropriate. If the limit does not exist, explain why.

1. $\lim\limits_{x\to -5} \frac{2x^2-5}{x-6}$

$= \frac{2(-5)^2-5}{-5-6}$

$= \boxed{-\frac{45}{11}}$

2. $\lim\limits_{x\to -5} \frac{x+5}{x^2+2x-15}$ $\frac{0}{0}$

$= \lim\limits_{x\to -5} \frac{(x+5)}{(x+5)(x-3)}$

$= \lim\limits_{x\to -5} \frac{1}{x-3}$

$= \frac{1}{-5-3} = \boxed{-\frac{1}{8}}$

3. $\lim\limits_{x\to 3} \frac{x^2-1}{x-3}$ $\frac{9-1}{0} = \frac{8}{0}$

$\boxed{\text{VA @ } x=3}$ - explanation

$\boxed{\text{DNE}}$ - answer

4. $\lim\limits_{x\to 2} \frac{2-\sqrt{6-x}}{x-2}$ $\frac{0}{0}$

$= \lim\limits_{x\to 2} \frac{(2-\sqrt{6-x})}{(x-2)} \cdot \frac{(2+\sqrt{6-x})}{(2+\sqrt{6-x})}$

$= \lim\limits_{x\to 2} \frac{4-(6-x)}{(x-2)(2+\sqrt{6-x})} = \lim\limits_{x\to 2} \frac{(x-2)}{(x-2)(2+\sqrt{6-x})}$

$= \lim\limits_{x\to 2} \frac{1}{2+\sqrt{6-x}} = \frac{1}{2+\sqrt{6-2}} = \frac{1}{2+2} = \boxed{\frac{1}{4}}$

5. $\lim\limits_{x\to -3} \frac{\frac{6}{x+5}-3}{x+3}$ $\frac{0}{0}$

$= \lim\limits_{x\to -3} \left(\frac{\frac{6}{x+5} - \frac{3x+15}{x+5}}{x+3}\right)$

$= \lim\limits_{x\to -3} \left(\frac{\frac{-3x-9}{x+5}}{x+3}\right)$

$= \lim\limits_{x\to -3} \left(\frac{-3(x+3)}{(x+5)} \cdot \frac{1}{(x+3)}\right)$

$= \lim\limits_{x\to -3} \left(\frac{-3}{x+5}\right)$

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

$= \boxed{-3/2}$

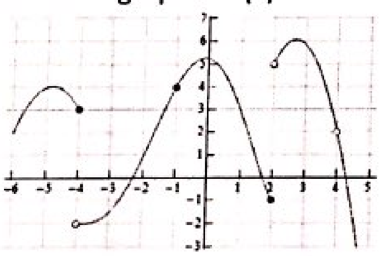
6. $\lim\limits_{x\to \infty} \frac{5x^2+6x-5}{2x^2-6}$ $= \boxed{5/2}$ - answer

HA@ $y = 5/2$ → work

7. $\lim\limits_{x\to -\infty} \frac{(x+3)^2(2x-5)^3}{x^3-6}$ $= \boxed{\text{DNE}}$ - answer

Unbounded behavior - explanation

Use the graph of f(x) to find the following.



8. $\lim\limits_{x\to 2^+} f(x) = \boxed{5}$

9. $\lim\limits_{x\to 2^-} f(x) = \boxed{-1}$

10. $\lim\limits_{x\to 4} f(x) = \boxed{2}$

11. $\lim\limits_{x\to -4} f(x) = \boxed{\text{DNE}}$

12. $f(2) = \boxed{-1}$

State the end behavior of each function using arrows.

13. $f(x) = \frac{(-2x+3)^3(x-3)^6}{x^2(x+2)^3}$ $\boxed{\downarrow\downarrow}$

$\frac{(-2x)^3(x)^6}{x^2(x^3)} = \frac{-x^9}{x^5} = -x^4$

14. $f(x) = \frac{0.17x^{25}-3.6x^{18}}{3-2x^5}$ $\boxed{\downarrow\downarrow}$

$\frac{.17x^{25}}{-2x^5} = -x^{20}$

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Use the function $f(x) = 4x^2 - 5x$ for questions 15-18.

15. Find the derivative of $f(x)$ using the limit definition. $\lim_{h \to 0} \frac{f(x+h)-f(x)}{h}$

$$\lim_{h \to 0} \frac{4(x+h)^2 - 5(x+h) - (4x^2 - 5x)}{h}$$

$$= \lim_{h \to 0} \frac{4x^2 + 8xh + 4h^2 - 5x - 5h - 4x^2 + 5x}{h}$$

$$= \lim_{h \to 0} \frac{8xh + 4h^2 - 5h}{h}$$

$$= \lim_{h \to 0} \frac{h(8x + 4h - 5)}{h}$$

$$= \lim_{h \to 0} (8x + 4h - 5) = 8x + 4(0) - 5 = \boxed{8x - 5}$$

16. Find the slope of the graph of $f(x)$ when x = -3.

$$8(-3) - 5 = \boxed{-29}$$

17. Write the equation of the tangent line at x = -3. Leave your answer in point-slope form.

Slope $= -29$

$$\boxed{y - 51 = -29(x+3)}$$

Point $(-3, 51)$

$4(-3)^2 - 5(-3)$

$= 4(9) + 15$

$= 36 + 15$

$= 51$

18. Find the x-value where the function has a horizontal tangent line.

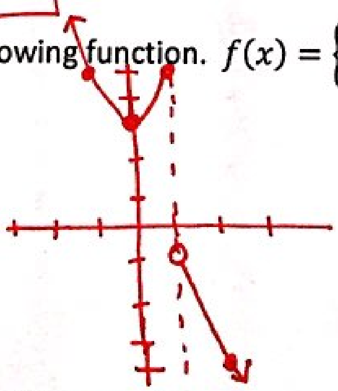
Horizontal line has a slope of 0, so...

$0 = 8x - 5$

$5 = 8x$

$\boxed{5/8 = x}$

19. Graph the following function. $f(x) = \begin{cases} 2x^2 + 3 & x \leq 1 \\ -3x + 2 & x > 1 \end{cases}$



Calculator Problems

20. Use the function $f(x) = \sqrt{x+3}$ for the following:

a. Find the domain of the function.

$x \geq -3$

b. Find the derivative using the limit definition. $\lim_{h \to 0} \frac{f(x+h)-f(x)}{h}$

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

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

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

$$= \lim_{h \to 0} \frac{h}{h(\sqrt{x+h+3} + \sqrt{x+3})} = \lim_{h \to 0} \frac{1}{\sqrt{x+h+3} + \sqrt{x+3}} = \frac{1}{\sqrt{x+3} + \sqrt{x+3}} = \boxed{\frac{1}{2\sqrt{x+3}}}$$

c. At which value of x is the tangent line of f(x) a horizontal line?

$m=0$

$0 = \frac{1}{2\sqrt{x+3}}$ (no solution)

There is not an x-value where tangent would be horizontal

21. Use your calculator to find the following limits. Round to 3 decimal places as necessary.

a. $\lim_{x \to -3} \frac{\sin(x+3)}{x^2+5x+6}$

$\boxed{-1}$

x	y
-3.002	-.998
-3.001	-.999
-3	—
-2.999	-1.001
-2.998	-1.002

b. $\lim_{x \to 0} \frac{\sin x}{3x} = \boxed{.333}$

x	y
-.002	$.3\bar{3}$
-.001	$.3\bar{3}$
0	—
.001	$.3\bar{3}$
.002	$.3\bar{3}$

22. Given $f(x) = \frac{26x+5}{x-2}$, find the following.

a. f(3) $= \frac{26(3)+5}{3-2} = \boxed{83}$

b. $\frac{dy}{dx}$ when x = 3

$\frac{dy}{dx} = -57.00006$ (use calculator)

c. Write the equation of the tangent line when x = 3.

$\boxed{y-83 = -57.00006(x-3)}$