Name _____

Part 1: Computational Skills. Choose 4 of the problems below to complete.

1) Find $\lim_{x\to 3}\frac{x^2-9}{x-3}$.

$$\lim_{x\to 3}\frac{x^2-9}{x-3}=\lim_{x\to 3}\frac{(x-3)(x+3)}{x-3}=\lim_{x\to 3}x+3=6$$

Or

$$\lim_{x\to 3}\frac{x^2-9}{x-3}=\lim_{x\to 3}\frac{2x}{1}=6$$

2) Find $\lim_{x\to\infty}\frac{2x^2+3x-5}{7x^2-4x+6}=\frac{2}{7}$

3) Find the derivative of $f(x)=\sin(3x)$

$$\frac{d}{dx}\sin(3x)=\cos(3x)\cdot 3$$

4) Find the derivative of $f(x)=(x^2+2x)(x^6+5)$

$$f'(x)=(2x+2)(x^6+5)+(x^2+2x)(6x^5)$$

5) Find $\int(x+6)^7dx$

$$\int(x+6)^7dx=\int u^7du=\frac{u^8}{8}+C=\frac{(x+6)^8}{8}+C$$

$$u=x+6$$
$$du=dx$$

6) Find $\int_1^3 x^2\,dx$

$$\int_1^3 x^2dx=\frac{x^3}{3}\Big|_1^3=\frac{3^3}{3}-\frac{1^3}{3}=9-\frac{1}{3}=8.\bar{6}$$

Part 2: Conceptual Understanding. Choose 2 of the problems below to complete.

7) Using the graph to the right, estimate $\lim_{x\to 2^-} f(x)$

Be sure to illustrate your answer on the graph.

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

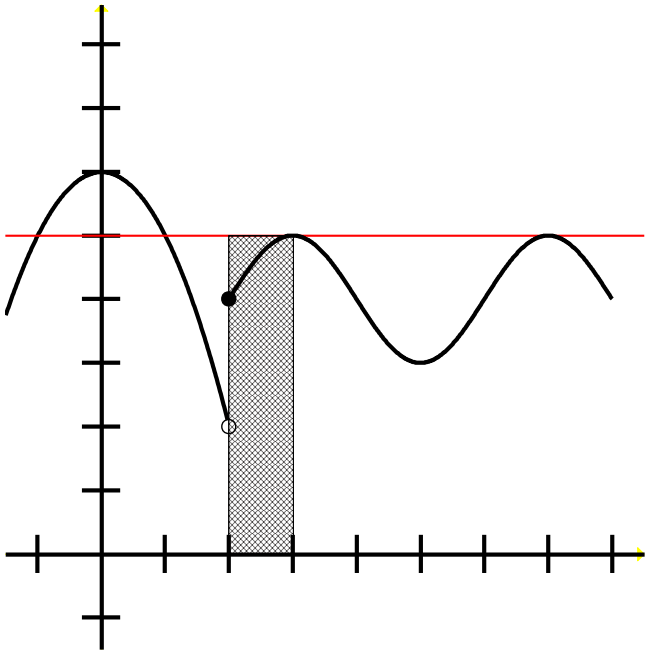
8) Using the graph to the right, estimate $f'(3)$

Be sure to illustrate your answer on the graph.

$f'(3) = 0$

9) Using the graph to the right, estimate $\int_2^3 f(x)dx$

Be sure to illustrate your answer on the graph.



There are many possible answers. I'm going to look at your illustration and check that it's correct, then check your work to see if it agrees with your illustration.
Here is a Right Riemann Sum with 1 rectangle:

$1 \cdot 5 = 5$

Part 3: Applications. Choose 1 of the problems below to complete.

10) A squirrel runs away from a toddler according to the velocity function $f(x) = 4 - x$, until it stops. How far does the toddler need to run in order to catch the squirrel?

11) A region is formed is enclosed by the curve $y = 3 - \sqrt{x}$, $x = 0$, and $y = 0$. Then A cone-like shape is constructed by rotating the region around the x-axis. What is the volume of this cone-like thing?

For the squirrel, it stops when the velocity is zero. That is, when $4 - x = 0$, or $x = 4$. The total distance the toddler traveled is then:

$$\int_0^4 4 - x = 4x - \frac{x^2}{2}\Big|_0^4 = 16 - 8 - (0 - 0) = 8$$

The toddler ran 8 …. Units? Feet? Meters? Inches? Miles? Why didn't I give a contextual problem units??? Arrrgh!!

For the volume, using the disk method it is:

$$\int_0^9 \pi\left(3 - \sqrt{x}\right)^2 dx$$

Or using the shell method, it is:

$$\int_0^3 2\pi y(3 - y)^2 dy$$