#3. (2 pts) $\lim_{t\to -3} \frac{2t^2+5t-3}{9-t^2} = \lim_{t\to -3} \frac{(2t-1)(t+3)}{(3+t)(3-t)} = \lim_{t\to -3} \frac{2t-1}{3-t} = \boxed{\frac{-7}{6}}$

#5. (3 pts)

$$\lim_{y\to 1} \frac{2-\sqrt{y^2+3}}{y^2+5y-6} = \lim_{y\to 1} \frac{2-\sqrt{y^2+3}}{y^2+5y-6}\frac{2+\sqrt{y^2+3}}{2+\sqrt{y^2+3}} = \lim_{y\to 1} \frac{4-(y^2+3)}{(y^2+5y-6)\left(2+\sqrt{y^2+3}\right)}$$

$$= \lim_{y\to 1} \frac{1-y^2}{(y^2+5y-6)\left(2+\sqrt{y^2+3}\right)} = \lim_{y\to 1} \frac{(1-y)(1+y)}{(y+6)(y-1)\left(2+\sqrt{y^2+3}\right)}$$

$$= \lim_{y\to 1} \frac{-(1+y)}{(y+6)\left(2+\sqrt{y^2+3}\right)} = \frac{-2}{28} = \boxed{-\frac{1}{14}}$$

#6. For **(a)** we can just use the lower formula since $11 \ge 6$ contains points on both sides in this interval. For **(b)** we'll need to look at the two one-sided limits since $x = 6$ is the cutoff point and no interval contains points on both sides of it.

(a) – NOT GRADED!!! $\lim_{x\to 11} g(x) = \lim_{x\to 11}(x^2-3) = \boxed{118}$

(b) (3 pts) First the one sided limits.

$$\lim_{x\to 6^-} g(x) = \lim_{x\to 6^-} \mathbf{e}^{2+x} = \mathbf{e}^8 \qquad \text{because } x < 6 \text{ in this case}.$$

$$\lim_{x\to 6^+} g(x) = \lim_{x\to 6^+} (x^2-3) = 33 \qquad \text{because } x > 6 \text{ in this case}$$

So, $\lim_{x\to 1} g(x)$ doesn't exist since the two one-sided limits are not the same.

#8. (2 pts) In both of these limits the numerator is staying fixed at 4 and as *x* approaches 7 (from either side) we can see that 7-*x* is approaching zero. So, we have a fixed number divided by something increasingly smaller and so it should make some sense that both of these are going to either ∞ or $-\infty$ and this will depend upon the sign of the denominator

In the first case 7-*x* is positive since $x < 7$ and raising this to the fifth power will keep it positive. So, in this case we have a fixed positive number in the numerator divided by something increasingly smaller positive number and so the limit in this case will be ∞.

In the second case 7-*x* is negative since $x > 7$ and raising this to the fifth power will keep it negative. So, in this case we have a fixed n number in the numerator divided by an increasingly smaller negative number and so the limit in this case will be $-\infty$.

$$\lim_{x\to 7^-} \frac{4}{(7-x)^5} = \infty \qquad \lim_{x\to 7^+} \frac{4}{(7-x)^5} = -\infty$$

Not Graded

#1.

(a) $f(-3) = -2 \qquad \lim_{x\to -3^-} f(x) = 2 \qquad \lim_{x\to -3^+} f(x) = 2 \qquad \lim_{x\to -3} f(x) = 2$

(b) $f(0) = 0 \qquad \lim_{x\to 0^-} f(x) = 0 \qquad \lim_{x\to 0^+} f(x) = 0 \qquad \lim_{x\to 0} f(x) = 0$

(c) $f(2) = \text{d.n.e} \qquad \lim_{x\to 2^-} f(x) = -4 \qquad \lim_{x\to 2^+} f(x) = -4 \qquad \lim_{x\to 2} f(x) = -4$

(d)

$f(3) = 2 \qquad \lim_{x\to 3^-} f(x) = 2 \qquad \lim_{x\to 3^+} f(x) = 4$

$\lim_{x\to 3} f(x) = \text{ doesn't exist b/c } \lim_{x\to -3^-} f(x) \neq \lim_{x\to -3^+} f(x)$

#2.

(a) $\lim_{x\to -2}\left[9g(x) - 2h(x)\right] = 9\lim_{x\to -2} g(x) - 2\lim_{x\to -2} h(x) = 9(-1) - 2(7) = \boxed{-23}$

(b) $\lim_{x\to -2}\left[1 - 5f(x)g(x)\right] = \lim_{x\to -2} 1 - 5\left[\lim_{x\to -2} f(x)\right]\left[\lim_{x\to -2} g(x)\right] = 1 - 5(8)(-1) = \boxed{41}$

(c) $\lim_{x\to -2}\frac{\left[f(x)\right]^3}{10 + h(x)} = \frac{\left[\lim_{x\to -2} f(x)\right]^3}{\lim_{x\to -2} 10 + \lim_{x\to -2} h(x)} = \frac{[8]^3}{10+7} = \boxed{\frac{512}{17}}$

#4. $\lim_{z\to -1}\frac{(z-4)(z+2) + 2 - 3z}{z^2 + 5z + 4} = \lim_{z\to -1}\frac{z^2 - 5z - 6}{z^2 + 5z + 4} = \lim_{z\to -1}\frac{(z+1)(z-6)}{(z+1)(z+4)} = \lim_{z\to -1}\frac{z-6}{z+4} = \boxed{-\frac{7}{3}}$

#7. Note that we can't just cancel the *h*'s since once is inside the absolute value bars. So, we'll use the hint and recall that,

$$|h| = \begin{cases} h & \text{if } h \geq 0 \\ -h & \text{if } h < 0 \end{cases}$$

With this we can do the two one sided limits to eliminate the absolute value bars.

$$\lim_{h\to 0^-}\frac{|h|}{h} = \lim_{h\to 0^-}\frac{-h}{h} = \lim_{h\to 0^-} -1 = -1 \qquad \text{because } h < 0 \text{ in this case}$$

$$\lim_{h\to 0^+}\frac{|h|}{h} = \lim_{h\to 0^+}\frac{h}{h} = \lim_{h\to 0^-} 1 = 1 \qquad \text{because } h > 0 \text{ in this case}$$

The two one-sided limits are not the same and so $\lim_{h\to 0}\frac{|h|}{h}$ does not exist

<u>#9.</u> In both of these limits the numerator is staying fixed at -5 and as *x* approaches -3 (from either side) we can see that *x+3* is approaching zero. So, we have a fixed number divided by something increasingly smaller and so it should make some sense that both of these are going to either ∞ or $-\infty$. Also note that in this case because we're squaring the denominator it will always be positive and so both of these limits will have a fixed negative numerator divided by an increasingly small positive number. Therefore, both will be $-\infty$.

Here are the official answers to this problem.

$$\lim_{t\to -3^-} \frac{-5}{\left(2x+6\right)^2} = -\infty \qquad\qquad \lim_{t\to -3^+} \frac{-5}{\left(2x+6\right)^2} = -\infty$$