Math 161 **Summer 2023**
Exam 1 Solutions **Drew Armstrong**

1A.

$$\lim_{x\to 2}\ \frac{x^2+x-6}{x-2} = \lim_{x\to 2}\ \frac{\cancel{(x-2)}(x+3)}{\cancel{x-2}} = 2+3 = 5$$

1B.

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

2A.

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

2B.

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

3A.

$$\lim_{\theta\to 0}\ \frac{\theta}{\tan(2\theta)} = \lim_{\theta\to 0}\ \frac{\theta}{\sin(2\theta)/\cos(2\theta)} = \lim_{\theta\to 0}\ \frac{\theta}{\sin(2\theta)}\cdot\cos(2\theta) = \frac{1}{2}\cdot 1 = \frac{1}{2}$$

3B.

$$\lim_{\theta\to 0}\ \frac{\sin(2\theta)}{\sin\theta} = \lim_{\theta\to 0}\ \frac{\theta}{\sin\theta}\cdot\frac{\sin(2\theta)}{\theta} = 1\cdot 2 = 2$$

4A.

$$\lim_{t\to 1^-}\ \frac{t+1}{t-1} = \frac{2}{\text{tiny negative number}} = -\infty$$

4B.

$$\lim_{t\to 2^+}\ \frac{t+2}{t-2} = \frac{4}{\text{tiny positive number}} = +\infty$$

5A.

$$\lim_{n\to\infty}\ \frac{(n+1)^2}{2n^2} = \lim_{n\to\infty}\ \frac{(n^2+2n+1)/n^2}{2n^2/n^2} = \lim_{n\to\infty}\ \frac{1+\frac{2}{n}+\frac{1}{n^2}}{2} = \frac{1+0+0}{2} = \frac{1}{2}$$

5B.

$$\lim_{n\to\infty}\ \frac{(2n+1)^2}{n^2} = \lim_{n\to\infty}\ \frac{(4n^2+4n+1)/n^2}{n^2/n^2} = \lim_{n\to\infty}\ \frac{4+\frac{4}{n}+\frac{1}{n^2}}{1} = 4+0+0 = 4$$