

8 September 2015

1. **Warm up:** Give the definitions, in your own words, of the terms below, and give an example of each.

- (a) polynomial function
- (b) rational function
- (c) exponential function

2. Create functions with the asymptotes at the given lines.

- (a)  $y = 0$
- (b)  $y = 1$  and  $x = 0$
- (c)  $y = -5$ ,  $x = -3$  and  $x = 6$
- (d)  $y = -1$  and  $y = 1$
- (e)  $x = 2k$  for every integer  $k$  (that is, for all  $k = \dots, -2, -1, 0, 1, 2, \dots$ )

3. Find the following limits, if they exist.

- (a)  $\lim_{x \rightarrow \infty} \left[ \frac{3x^5 - 2x}{x^5 + 3x^4} \right]$
- (b)  $\lim_{x \rightarrow -\infty} \left[ \frac{x^5 + 7x^3 - 10}{x^7 + 14x^6} \right]$
- (c)  $\lim_{x \rightarrow \infty} \left[ \frac{x^2 + 3x - 2}{\sqrt{3x^4 + 5x^3 - 2x + 1}} \right]$
- (d)  $\lim_{x \rightarrow -\infty} \left[ \sqrt{\frac{2x^2 + 2}{5x^5 - 3x^3 + 2x^2 + 2}} \right]$
- (e)  $\lim_{x \rightarrow -\infty} \left[ x + \sqrt{x^2 + 3x} \right]$
- (f)  $\lim_{x \rightarrow \infty} \left[ \frac{\cos(x)}{\sqrt{x}} + 2 \right]$

4. Consider the functions below. For all pairs of functions, find the limits, if they exist, as  $x \rightarrow \infty$  and  $x \rightarrow -\infty$  of both ratios of the pair.

- (a)  $x$
- (b)  $\sin(x)$
- (c)  $e^x$
- (d)  $\ln(x)$
- (e)  $\tan^{-1}(x)$

5. **Bonus:** Imagine a rope around the Earth at the equator. Add a 20 meter segment to the rope. The new rope is held in a circular shape centered at the Earth. How far off the ground is the new rope? Assume the Earth is a perfect sphere.