

Midterm 1 Review
Problems from chapter 1 and sections 2.1-2.3

1. Find the limits.

(a) $\lim_{x \rightarrow \infty} \frac{x^3 - 2x^2 + \sqrt[5]{4x^{19}} - 1}{2x^2 - 4x^4}$

(b) $\lim_{x \rightarrow -\infty} \frac{3x^3 - 4x^2 + 5x}{1 - 7x^3}$

(c) $\lim_{x \rightarrow \infty} \frac{-5x^9 - 8x^7 + 3}{x^2 + x + 1}$

2. Find the limits.

(a) $\lim_{x \rightarrow 0} \frac{\sin(3x) \tan(5x) + 2x}{x \cos x}$

(b) $\lim_{x \rightarrow 4} \frac{3x^2 - 5x - 28}{x^2 - 16}$

3. Find the limits.

(a) $\lim_{x \rightarrow 1} \frac{(x+2)(x-5)}{(x-1)x^2(x+3)}$

(b) $\lim_{x \rightarrow 3^+} \frac{x+2}{\sqrt{x-3}}$

4. Describe the discontinuities for the function $f(x) = \frac{x^3(4x-1)(x+2)}{(x+2)(x-5)(x^2)}$.

5. Use the definition of the derivative to find $f'(x)$.

(a) $f(x) = \frac{1}{\sqrt{2x-1}}$

(b) $f(x) = x^3 + 5$

6. Find the derivatives (using shortcuts). Don't simplify your answers.

(a) $y = \sin x \sec x + \cos x$

(b) $y = (3x^{-5} + \pi x^2 - 7)(x^{-6} + 9)$

(c) $y = \frac{4x^2 + 3x - 8}{(x+1)(x^2+1)}$

7. Find the equation of the tangent line to $y = \frac{1+x}{x^2-3}$ at $x = 1$.

Answer Key:

1: (a) 0 (b) $\frac{-3}{7}$ (c) $-\infty$

2: (a) 2 (b) $\frac{19}{8}$

3: (a) DNE (because the right and left hand limits are not the same)
(b) ∞

4: VA at $x=5$; holes at $x=0, -2$; only the holes are patchable

5: (a) $f'(x) = \frac{-1}{(2x-1)^{3/2}}$ (b) $f'(x) = 3x^2$

6: (a) $y' = \sec^2 x - \sin x$ (b) $y' = (-15x^{-6} + 2\pi x)(x^{-6} + 9) + (3x^{-5} + \pi x^2 - 7)(-6x^{-7})$
(c) $y' = \frac{(x+1)(x^2+1)(8x+3) - (4x^2+3x-8)[1(x^2+1) + (x+1)(2x)]}{(x+1)^2(x^2+1)^2}$

7: $y = -\frac{3}{2}x + \frac{1}{2}$