Calculus 2 Prep Problems

Limits

Use L'Hopital's Rule to solve the following problems:

1. $\lim_{x \to 0} \frac{\sin(x)}{x}$

2. $\lim_{x \to \infty} \frac{4x^2 + 12}{e^x}$

Continuity

Find all asymptotes and holes in the following functions. State the interval(s) on which each function is continuous.

3. $f(x) = |2x + 2|$

4. $h(x) = e^{-x}$

5. $g(x) = \dfrac{x}{x^2 - 25}$

Derivatives

Use the indicated rule to derive each of the following functions.

Power Rule

6. $\frac{d}{dx} 5x^{20}$

Product Rule

7. $\frac{d}{dx} e^x \sin(x)$

Quotient Rule

8. $\frac{d}{dx} \frac{2x}{\sin(x)}$

Chain Rule

9. $\frac{d}{dx}\ 5(x-3)^2$

10. $\frac{d}{dx}\sin(\ln(x))$

Identifying Derivative Rules

Which rule(s) do you need to solve these? Then take the derivative.

11. $\frac{d}{dx}\frac{3}{x^3}$

12. $\frac{d}{dx}\frac{\sin(x)\cos(x)}{2x}$

13. $\frac{d}{dx}2x\sin(x)\cos(x)$

14. $\frac{d}{dx}\left[\frac{1}{\sin(x)}+\frac{2}{\sin^2(x)}\right]$

Extrema

Solve $f'(x) = 0$ to find critical points and identify the maximum and minimum of the function:

15. $f(x) = x^3 + 3x^2 + x$

Concavity

Solve $f''(x) = 0$ to find inflection points, and identify areas of concavity.

16. $f(x) = \frac{1}{12}x^4 - \frac{7}{6}x^3 - 9x^2 + 12x + 5$

Sketch the graph for the given functions by using properties of derivatives

17. $f(x) = x^3 + 3x^2 + x$

18. $f(x) = \frac{1}{12}x^4 - \frac{7}{6}x^3 - 9x^2 + 12x + 5$

Integrals

Solve the following integrals by area – do not take the integral!

19. $f(x) = \begin{cases} 5x, & x < 5 \\ 25, & 5 \le x < 10 \\ -5x + 75, & x \ge 10 \end{cases}$, $\int_0^{15} f(x)dx$

20. $h(x) = \sqrt{36 - x^2}$, $\int_{-6}^{6} h(x)dx$

Solve the following integrals with the specified rule.

Power Rule

21. $\int 5x^7 + 3x^2 dx$

22. $\int x^{-5} + 3dx$

U-substitution

23. $\int 2x(x^2 + 4)^3 dx$

24. $\int \sin(x)\cos^2(x)\, dx$

2nd Fundamental Theorem of Calculus

25. $\int_0^{\pi} \sin(x)\, dx$

26. $\int_{-1}^{1} 2x^3 dx$