November Break Extra Credit

1. Find the domain of $f(x) = \sqrt{2x+3}$

2. Find the domain of the function $f(x) = \ln(5x-2)$

3. Assume $f(x) = \frac{e^x}{e^x-1}$. Find $f^{-1}(x)$.

4. Find the asymptotes of $y = \frac{5x-14}{x^2-4x}$

5. $\lim_{h\to 16} \frac{x-16}{\sqrt{x}-4} =$

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

7. $\lim_{x\to 0} \frac{\sin 5x}{\sin 8x} =$

8. $\lim_{x\to 7^-} \frac{x+9}{x-7} =$

9. Which of the following functions are continuous for all real numbers x?
   a. $y = \frac{x^2+5}{x^2+2}$
   b. $y = \frac{3}{x^2}$
   c. $y = |2x-7|$

10. Let f be defined as follows:
$$f(x) = \begin{cases} \dfrac{x^2-9}{x-3}, & x \neq 3 \\ 1, & x = 3 \end{cases}$$
Which of the following are true about f?
   a. $\lim_{x\to 3} f(x)$ exists
   b. $f(3)$ exists
   c. $f(x)$ is continuous at $x = 3$

11. Consider the function
$$f(x) = \begin{cases} x^2+5, & x > 5 \\ 3ax, & x \leq 5 \end{cases}$$
For what value of a is the function continuous?

12. By applying the Intermediate Value Theorem, what interval will $2^x = \sin(2x) + 5$ have a solution?

13. The function f and g are differentiable and have the values shown in the table. If $A = f \cdot g$ the $A'(0) =$

x	f	f'	g	g'
0	6	1	-8	1/3
2	8	3	-5	1
4	14	9	-3	4
6	26	27	-1	16

14. The function f and g are differentiable and have the values shown in the table. If $A = \sqrt{f(x)}$ the $A'(-2) =$

x	f	f'	g	g'
0	6	1	-8	1/3
2	8	3	-5	1
4	14	9	-3	4
6	26	27	-1	16

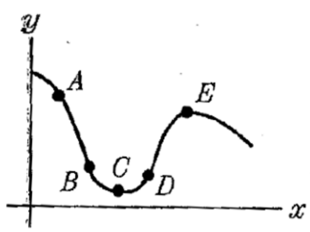
15. A function f is given by the table shown. Estimate $f'(4.3)$.

x	3.7	4.3	4.9	5.5	6.1
$f(x)$	1.8	3.4	4.6	6.4	8.4

16. A function f is given by the table shown and is differentiable over its domain. What is the best estimate of $f'(0.14)$?

x	0.14	0.34	0.54	0.74	0.94
$f(x)$	9.352	7.044	4.826	2.102	0.288

17. At which of the five points shown on the graph are $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ both positive?



18. Let $f(x) = x^2(x-3)$. Over what interval is the function increasing?

19. Let $f(x) = \ln x^x$. Over what interval is the function increasing or decreasing?

20. Given the function $f(x) - 1 = x^3$ satisfies the hypothesis of the Mean Value Theorem on the interval $[-2,4]$, find the number C in the interval $(-2,4)$ which satisfies this theorem.

21. What is the average rate of change over $2 \leq t \leq 4$?

t	2	3	4	5	6
$f(t)$	1.8	3.4	4.6	6.4	8.4

22. Given the position function $s = t^2 + 9t - 5$, what is the instantaneous rate of change at $t = 3$?

23. Find the point of inflection of $f(x) = x^3 - 3x^2 - x + 7$

24. Find the interval(s) on which the curve $y = x^3 - 3x^2 - 9x + 6$ is concave upward or concave downward.

25. Given a continuous function f and the following information, sketch a possible graph of f.

Interval	Sign of f'	Sign of f''
$x < -4$	$+$	$-$
$-4 < x < -2$	$-$	$-$
$-2 < x < 0$	$-$	$+$
$0 < x$	$+$	$+$

26. $\lim_{x \to 0} \frac{e^x - e^{-x}}{4x} =$

27. If $y = \ln(x^2 + 3x)$, then $\frac{dy}{dx} =$

28. Find $\frac{dy}{dx}$ given $y = \ln(8 - x)^4$

29. A curve is defined by $y = e^{\sin 2x}$. Find $\frac{dy}{dx}$.

30. Find the critical numbers, if any, of $f(x) = \frac{x-1}{x+3}$

31. Given a function defined by $f(x) = 3x^5 - 5x^3 + 12$, for what value(s) of x is there a relative maximum?

32. Find the relative extrema of the function $f(x) = 3x^5 - 5x^3$?

33. Given $f(x) = x^3 - 3x^2 - 9x$ find the absolute maximum value on the closed interval $[0,6]$.

34. If $f(x) = \cos^4 x$, then $f'\left(\frac{\pi}{3}\right) =$

35. Given $f(x) = \frac{x}{\tan x}$, find $f'\left(\frac{3\pi}{4}\right)$

36. Find the derivative, $\frac{dy}{dx}$, of $y = \frac{2x}{1-3x^2}$.

37. If $f(x) = \frac{x^3+3x^2+2}{x}$, then $f'(1) =$

38. Find the derivative of $x^2 f(x)$

39. If $f(x) = \sin x \cos x$, then $f'\left(\frac{\pi}{6}\right) =$

40. Find an equation for the tangent line to the graph of $f(x) = \sqrt{x-7}$ at the point where $x = 16$.

41. Find the slope of the tangent line to the graph of $y = \ln(xe^x)$ at the point where $x = 3$.

42. Given $y = \arcsin(5x)$, then $\frac{dy}{dx} =$

43. Find the derivative: $s(t) = \sin\left(\frac{t}{2}\right)$

44. Given $2x = xy + y^2$, then $\frac{dy}{dx} =$

45. Given $2x^2 + xy + 3y^2 = 0$, then $\frac{dy}{dx} =$

46. A projectile starts at time $t = 0$ and moves along the x-axis so that its position at any time $t \geq 0$ is $x(t) = t^3 - 6t^2 + 9t + 12$. What is the velocity of the particle at $t = 0$.

47. A projectile starts at time $t = 0$ and moves along the x-axis so that its position at any time $t \geq 0$ is $x(t) = t^3 - 6t^2 + 9t + 12$. During what time intervals is the particle moving to the left?

48. A point moves along the curve $y = \sqrt{x}$ in such a way that the y-value is increasing at the rate of 2 units per second. At what rate is x changing when $x = \frac{1}{2}$?

49. A man $2m$ tall walks away from a lamppost whose light is $5m$ above the ground. If he walks at a speed of $1.4\,m/s$, at what rate is his shadow growing when he is $10m$ from the lamppost?

50. A balloon rises vertically at the rate of $10\,ft/sec$. A person watches the balloon ascend from a point on the ground $100ft$ away from the spot below the rising balloon.

51. Evaluate $\int \frac{2x^2+3x^{\frac{1}{2}}+4}{x^{\frac{1}{2}}}dx$

52. Evaluate $\int_0^{16} 2\sqrt[4]{x^3}dx$

53. Evaluate $\int_2^7 |x-4|dx$

54. Suppose $\int_0^5 f(x)dx = 7$ and $\int_2^5 f(x)dx = -1$ find $\int_0^2 f(x)dx$

55. Evaluate $\int x(x^2-1)^4 dx$

56. If $\frac{dy}{dx} = \cos^7 x \sin x$, then $y =$

57. Evaluate $\int x\sqrt{x+1}\, dx$

58. Evaluate $\int \frac{7e^x}{e^x+5} dx$

59. Find the indefinite integral: $\int \frac{x}{16+x^4} dx$

60. On the planet Mathematica the population in the year 2000 was about 8 billion. If the population is growing according to $P(t) = 8e^{0.021t}$ then write a definite integral that gives the population for the 10-year period starting from the year 2000. Assume $t = 0$ at the beginning of the year 2000.

61. Evaluate $\frac{d}{dx}\int_1^x \sqrt{3\cos^2 t + 4}\, dt$

61. Evaluate $\frac{d}{dx}\int_{x^6}^1 \frac{dt}{2t-5}$

63. Find the equation of the family of curves $\frac{dy}{dx} = 12x^2 + 4x$ that passes through the point $(-1, -5)$

64. Evaluate $\int x^2 \ln x\ dx$

Calculator Section

65. Which of the following is an approximate root of $y = \sin(3x) + 1$

66. If $f(7) = 2$ and $f'(7) = 9$, then the tangent line approximation at $x = 7$ is what?

67. If $f(5) = 9$ and $f'(5) = -2$, then $f(5.011) =$

68. Consider the integral $\int \frac{1}{x} dx$ from $x = 1$ to $x = 4$. Using a Riemann sum with 6 sub-intervals calculate the area under the curve, and above the x-axis, using right endpoints. Answer to 3 decimal places.

69. Use a Trapezoidal approximation for $\int_1^3 x^3\, dx$ with $n = 4$.

70. The following table shows selected coordinates for $y = f(x)$. Given that f is continuous on $[1,4]$, find a trapezoidal approximation with $n = 3$, for the area under the curve from $x = 1$ to $x = 4$.

x	1	2	3	4
y	1.2	2.3	2.5	4.9

71. Approximate $\int_{0.3}^{7.6} \frac{1}{\sqrt[4]{x}} dx$