Name: **Final Exam (Version A)**

Instructions: This exam is closed book, closed note, and an individual effort. Electronic devices other than approved calculators are not allowed on your person (e.g., no cell phones or calculators with CAS). Remove any smartwatches and non-religious head-wear. Cheating of any kind will not be tolerated and will result in a grade of zero.**You must clear the memory on your calculator before beginning the exam.** Answer each question. **Show all work to receive full credit.** Unless the question specifies, you may provide either an exact answer or round to two decimal places. **Write your answers on the test with all work on a seperate piece of paper**. You have **2 hour 30 minutes** to finish the exam. Answer all questions to the best of your ability. Unless otherwise specified, you are required to **SHOW ALL YOUR WORK** to receive full credit. The exam has 220 possible points. You will be graded out of 200 points.

Questions	Possible	Score		Possible	Score
Question 1	16		Question 7	20	
Question 2	20		Question 8	20	
Question 3	20		Question 9	16	
Question 4	20		Question 10	20	
Question 5	12		Question 11	16	
Question 6	20		Question 12	16	
Extra Credit	4			Total	

1. If $f''(a) < 0$, $f(x)$ is _____ at a.

   (a) Increasing

   (b) Decreasing

   (c) Concave up

   (d) AConcave down

2. If the demand curve and supply curve are linear, then consumer surplus equals producer surplus.

   (a) Duh! True

   (b) AThis is illogical. False

   (c) I demand this question be taken off the exam

3. Let $f'(3) = 0$, $f''(1) = 0$, and $f'(2) = 0$. Also, let $f'(x) < 0$ for $x < 2$ and $x > 3$, $f'(x) > 0$ for $2 < x < 3$, $f''(x) < 0$ for $x < 1$, and $f''(x) > 0$ for $x > 1$. Determine the local maxima(s), local minima(s), and inflection point(s). **Clearly label which is which**.

   (a) Max: $x = 2$, Min: $x = 3$, and Inflection: $x = 1$

   (b) AMax: $x = 3$, Min: $x = 2$, and Inflection: $x = 1$

   (c) Max: $x = 1$, Min: $x = 2$, and Inflection: $x = 3$

   (d) Max: $x = 3$, Min: $x = 1$, and Inflection: $x = 2$

4. If $f(x)$ and $g(x)$ are continuous on $[a, c]$, $\int_a^b f(x)\,dx = 13$, and $\int_b^c f(x)\,dx = 37$, determine $\int_a^c f(x)\,dx$.

   (a) A50

   (b) -24

   (c) -50

   (d) 24

5. If an exponential function $f(t)$ in terms of t has a constant percent increase r and intitial value 300, then $f(t) = 300r^t$.

   (a) I like it. True

   (b) AI hate it. False

   (c) I'm indifferent.

6. If $A(n)$ is the area of a plot of horse farm land, in acres, necessary for n, the number of horses, interpret $A'(50) = .5$.

   (a) AFor fifty-first horse, the area increases by half an acre.

(b) The area of land is half an acre when there are fifty horses.

(c) For the fifty-first acre, the number of horses increases by half a horse.

(d) The number of horses is one half when there is fifty acres of land.

7. If an apple's diameter, d cm, is inversely proportional to the square of the number of apples in the tree, a, then what is a formula, given constant of proportionality k, for the relationship?

   (a) $d = ka^2$

   (b) $a = kd^2$

   (c) A$d = \dfrac{k}{a^2}$

   (d) $a = \dfrac{k}{d^2}$

8. Let $(12, 50)$ be the break-even point for a given cost and revenue function with quantity 12 and dollar amount \$50. Then at a quantity of 13, the company is not making a profit.

   (a) Correct! True

   (b) ALies! False

   (c) I like money

9. Expand the following logarithm so there are no powers, division, or multiplication inside the logarithm: $\ln\left(\dfrac{3x^4}{7\sqrt{y}}\right)$.

   (a) $4\ln(3) + 4\ln(x) - (1/2)\ln(7) - (1/2)\ln(y)$

   (b) A$\ln(3) + 4\ln(x) - \ln(7) - (1/2)\ln(y)$

   (c) $4\ln(3) + 4\ln(x) - (1/2)\ln(7) + (1/2)\ln(y)$

   (d) $\ln(3) + 4\ln(x) - \ln(7) + (1/2)\ln(y)$

10. $\frac{d}{dx}\Big[h(k(x))\Big] = h'(k'(x))$

    (a) I got this down! True

    (b) AHow could this possibly be true. False

    (c) I'm just here so I don't get fined.

11. If marginal revenue is greater than marginal cost, the producer should produce and sell an additional unit.

    (a) ADing Ding Ding! That's Corrrrrect! True

    (b) Umm... no. False

    (c) *Jeopardy waiting music playing*

12. $\frac{d}{dx}a^x =$ _____ where a is constant and not 0.

(a) $a^x + C$

(b) a^x

(c) $\ln(a)a^x + C$

(d) $A\ln(a)a^x$

13. $\int k \cdot f(x)\,dx = \int k\,dx \cdot \int f(x)\,dx$ where k is a constant.

(a) What a beautiful statement! True

(b) AFilthy lies! False

(c) Is this the Krusty Krab?

14. $\int a(t)\,dt = \dfrac{d}{dt}(d(t))$ where $a(t)$ is the acceleration function, $v(0) = 0$, and $d(t)$ is the distance function.

(a) AFlawless! True

(b) Pathetic attempt Tommy... False

(c) No, this is Patrick!

15. If $f''(3) = 0$, then $x = 3$ is an inflection point.

(a) Of course! True

(b) AI'm no sucker for your games! False

(c) To be or not to be am I right Tommy?

For the next two questions, you are to determine which of the choices is the derivative of the function given.

16. $f(x) = 3e^x + 6x^3 - 7\ln(x) - 6^x + e^2$

(a) $3e^x + 18x^2 - \dfrac{7}{x} - 6^x$

(b) $A3e^x + 18x^2\dfrac{7}{x} - \ln(6)6^x$

(c) $3e^x + 12x^2 - \dfrac{7}{x} - 6^x$

(d) $3e^x + 9x^2 - \dfrac{7}{ln(x)} - 6^x$

17. $f(x) = \frac{e^x}{x^2}$

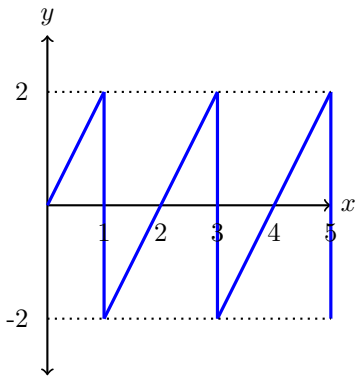
(a) $A\dfrac{xe^x(x-2)}{x^4}$

(b) $\dfrac{xe^x(2-x)}{x^4}$

(c) $\dfrac{xe^x(x-2)}{x^2}$

(d) $\dfrac{xe^x(2-x)}{x^2}$

Let the following graph represent the function $f(x)$ such that the pattern depicted goes on infinitely. Use the graph to answer questions (18) - (21).



18. $\displaystyle\int_0^{32} f(x)\,dx$

    (a) A0

    (b) -2

    (c) -1

    (d) 1

19. $\displaystyle\int_0^{4041} f(x)\,dx$

    (a) 0

    (b) -2

    (c) -1

    (d) A1

20. $\displaystyle\int_1^{352} f(x)\,dx$

    (a) 0

    (b) -2

    (c) A-1

    (d) 1

21. $\displaystyle\int_1^{54321} f(x)\,dx$

    (a) A0

    (b) -2

(c) -1

(d) 1

22. $\int -\frac{3}{x} + \frac{5}{2x^{1/3}} - e^x + 2\,dx =$

(a) $3\ln(x) + \frac{15}{4x^{2/3}} - e^x + 2x + C$

(b) $3\ln(x) + \frac{15}{2x^{1/3}} - e^x + 2x + C$

(c) A$3\ln|x| + \frac{15}{4x^{2/3}} - e^x + 2x + C$

(d) $3\ln|x| + \frac{15}{2x^{1/3}} - e^x + 2x + C$

23. $\int_0^{\ln(2)} \frac{e^x - e^{-x}}{e^x + e^{-x}}\,dx =$

(a) Aln(1.25)

(b) ln(.5)

(c) ln(2)

(d) ln(6)

24. $\int x(x+2)^6\,dx =$

(a) $\frac{(x+2)^8}{8} - \frac{2(x+2)^7}{7}$

(b) $\frac{x^8}{8} - \frac{2x^7}{7}$

(c) $\frac{x^8}{8} - \frac{2x^7}{7} + C$

(d) A$\frac{(x+2)^8}{8} - \frac{2(x+2)^7}{7} + C$

25. $\int_1^e \frac{\sqrt{\ln(x)}}{x}\,dx =$

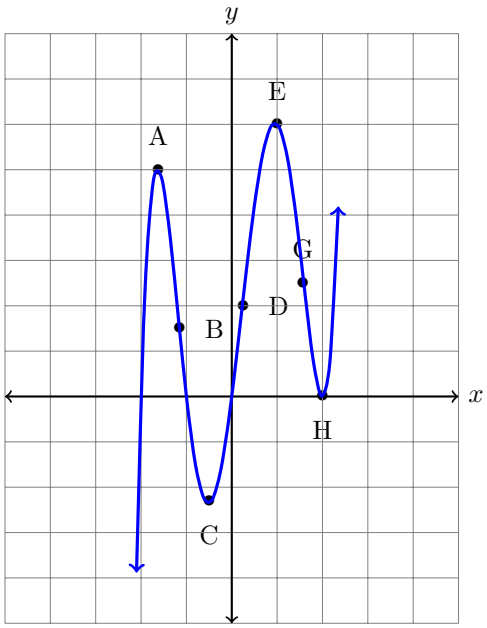
(a) A$\frac{1}{2}$

(b) 0

(c) DNE

(d) $\frac{1}{e}$

Given the graph below where $A = (a, f(a))$, $B = (b, f(b))$, $C = (c, f(c))$, $D = (d, f(d))$, $E = (e, f(e))$, $G = (g, f(g))$, and $H = (h, f(h))$, answer questions (26) - (33).



26. Determine the local minima and local maxima of the graph.

    (a) Max: A and H, Min: C and E

    (b) Max: D, Min: B and G

    (c) Max: E, Min: C

    (d) AMax: A and E, Min: C and H

27. Find the intervals for which the function is increasing and the intervals for which the function is decreasing and label which are increasing and which are decreasing.

    (a) AInc: $(-\infty, a)$, (c, e), and (h, ∞) Dec: (a, c) and (e, h)

    (b) Dec: $(-\infty, a)$, (c, e), and (h, ∞) Inc: (a, c) and (e, h)

    (c) Inc: (c, e) Dec: (a, c) and (e, h)

    (d) Dec: (c, e) Inc: (a, c) and (e, h)

28. Find the intervals for which the function is concave up and the intervals for which the function is concave down and label which are concave up and which are concave down.

    (a) Up: (a, e) and (e, ∞) Down: $(-\infty, c)$ and (c, h)

    (b) Down: (a, e) and (e, ∞) Up: $(-\infty, c)$ and (c, h)

    (c) AUp: (b, d) and (g, ∞) Down: $(-\infty, b)$ and (d, g)

    (d) Down: (b, d) and (g, ∞) Up: $(-\infty, b)$ and (d, g)

29. Find all inflection points on the graph.

    (a) A, C, E, H

(b) B, D

(c) A, E

(d) A B, D, G

30. On the interval $[a, d]$, determine the global maximum and minimum.

(a) Max: D Min: B

(b) Max: A Min: B

(c) Max: D Min: C

(d) AMax: A Min: C

31. On the interval $[b, d]$, determine the global maximum and minimum.

(a) Max: D Min: B

(b) Max: A Min: B

(c) AMax: D Min: C

(d) Max: A Min: C

32. On the interval $[d, g]$, determine the global maximum and minimum.

(a) AMax: E Min: D

(b) Max: E Min: G

(c) Max: G Min: D

(d) Max: E Min: H

33. On the interval $[a, h]$, determine the global maximum and minimum.

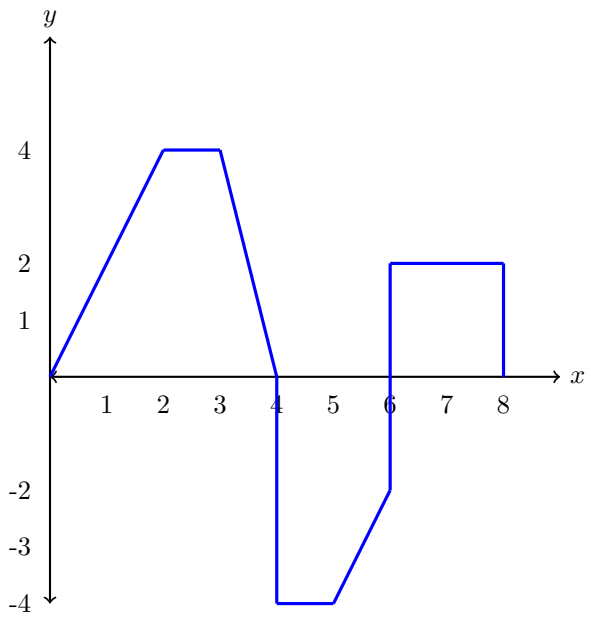
(a) Max: E Min: H

(b) AMax: E Min: C

(c) Max: A Min: H

(d) Max: A Min: C

Given the graph below of $f(x)$ answer questions (34) - (45):



34. $\int_0^2 f(x)\,dx$

    (a) A4

    (b) 2

    (c) 8

    (d) 12

35. $\int_2^3 f(x)\,dx$

    (a) A4

    (b) 2

    (c) 8

    (d) 12

36. $\int_0^4 f(x)\,dx$

    (a) 14

    (b) 8

    (c) A10

    (d) 12

37. $\int_4^5 f(x)\,dx$

    (a) 4

(b) 8

(c) -2

(d) A-4

38. $\int_5^6 f(x)\,dx$

(a) A-3

(b) -2

(c) -6

(d) 2

39. $\int_0^6 |f(x)|\,dx$

(a) 3

(b) 4

(c) 18

(d) A17

40. $\int_6^8 f(x)\,dx$

(a) A4

(b) 2

(c) 8

(d) 12

41. $\int_4^6 f(x)\,dx$

(a) A-7

(b) 2

(c) -8

(d) 8

42. $\int_4^8 f(x)\,dx$

(a) 3

(b) 11

(c) A-3

(d) 12

43. $\int_4^8 |f(x)|\,dx$

(a) 3

(b) A11

(c) -3

(d) 12

44. $\int_0^8 |f(x)|\,dx$

(a) 3

(b) A21

(c) 7

(d) 11

45. $\int_0^8 f(x)\,dx$

(a) 3

(b) 21

(c) A7

(d) 11