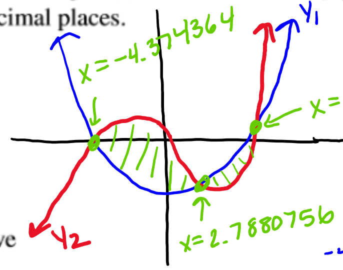
MATHEMATICS TEXAS A&M UNIVERSITY

Week-in-Review#11 - Final Exam Review
Math 142 - Fall 2024, by K. Kilmer

Please note that this is not an all-inclusive review. This is just a sampling of problems from the semester. To work more problems, please see WIR#1-WIR#10. I will be working through a subset of these problems at the live review.

1. What is the total area of the region(s) bounded between $f(x) = \frac{1}{3}x^2 - 6$ and $g(x) = \frac{1}{10}x^3 - 2x$? Note: Answers are rounded to four decimal places.

   (a) 34.9847
   (b) 1.3281
   (c) 33.6566
   (d) 36.3128
   (e) None of the above

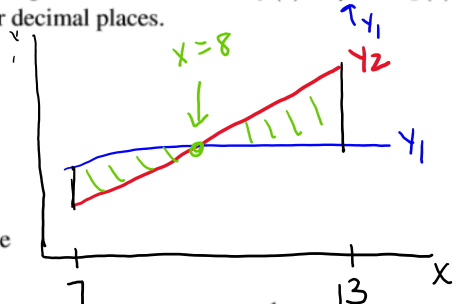


Zoom 6: ZStandard. Use fnInt!

$$\int_{-4.374364}^{2.7880756} (Y_2 - Y_1)\,dx + \int_{2.7880756}^{4.9196221} (Y_1 - Y_2)\,dx = 34.98470487 + 1.328124263 \approx 36.3128$$

2. Find the area of the region bounded between $f(x) = \sqrt[3]{x}$ and $g(x) = \frac{1}{4}x$ on the interval $[7, 13]$. Note: Answers are rounded to four decimal places.

   (a) 2.2816
   (b) 2.1995
   (c) 0.0821
   (d) 2.1174
   (e) None of these

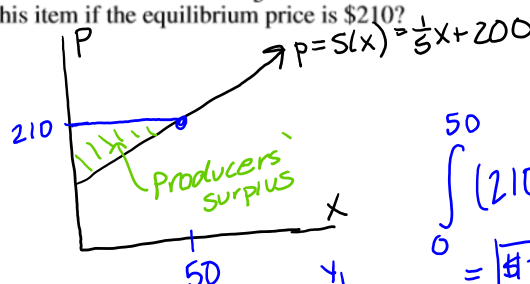


Window: x-min=7, x-max=13. Zoom 0: ZoomFit. Use fnInt!

$$\int_{7}^{8} (Y_1 - Y_2)\,dx + \int_{8}^{13} (Y_2 - Y_1)\,dx \approx 0.0821112904 + 2.199486795 \approx 2.2816$$

3. Given the price-supply equation $p = S(x) = \frac{1}{5}x + 200$ dollars, when x items are supplied, what is the producers' surplus for this item if the equilibrium price is $210?

   (a) $5,250
   (b) $250
   (c) $10,500
   (d) $375
   (e) None of these



Equil Quantity? $210 = \frac{1}{5}x + 200$, $10 = \frac{1}{5}x$, $50 = x$. Use fnInt!

$$\int_{0}^{50} \left(210 - \left(\tfrac{1}{5}x + 200\right)\right) dx = \$250$$

4. A particular item has a supply equation given by $p = 20e^{0.01x}$ dollars, which gives the price per item when x items are supplied. The quantity of items demanded is 300 when the price is $35 each, but for each additional $4 increase in price, the quantity demanded decreases by 5 items. Assuming the demand equation is linear, what is the Producer's Surplus at the market equilibrium? Note: Do not round anything until your final answer. The final answers are rounded to the nearest dollar.

   (a) $26,465
   (b) $12,789
   (c) $13,676
   (d) $15,832
   (e) None of these

Demand (x, p) — quantity, unit price

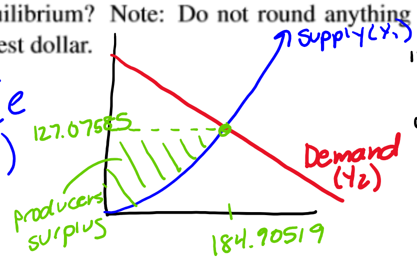
$(300, 35)$ $(295, 39)$

$m = \frac{39-35}{295-300} = \frac{4}{-5}$

$p - 35 = -\frac{4}{5}(x - 300)$

$p = -\frac{4}{5}x + 240 + 35$

$p = -\frac{4}{5}x + 275$ (Y2)



$$\int_{0}^{184.90519} (127.07585 - Y_1)\,dx \approx \$12789$$

5. Evaluate the following limit: $\lim_{x\to\infty} \frac{-4x^2+2-5x^3}{10-x^2}$

(a) 4

(b) $-\frac{2}{5}$

(c) 0

(d) $-\infty$

(e) None of the above

6. Given the graph of $f(x)$ and $g(x)$ below, what is the value of $h'(-3)$ if $h(x) = f(x)\cdot g(x)$?

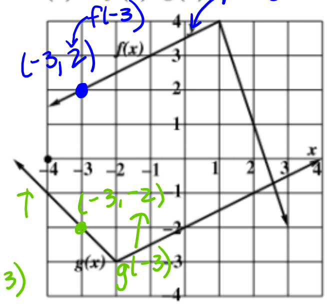
(a) -3

(b) $-1/2$

(c) -4

(d) -1

(e) None of the above



7. You are asked to find two non-negative numbers x and y with $2x+y=20$ for which the term xy^2 is maximized.

In solving this problem, you would need to solve the following:

(a) Maximize $P(x) = 400x - 80x^2 + 4x^3$ on $[0,10]$

(b) Maximize $P(x) = 400x - 80x^2 + 4x^3$ on $[0,\infty)$

(c) Maximize $P(x) = x^3$ on $[0,\infty)$

(d) Maximize $P(x) = 2x + \sqrt{x} - 20$ on $[0,10]$

(e) None of the above

8. Which of the following represents $f'(x)$ if $f(x) = \sqrt{x+3}$?

(i) $\lim_{h\to 0} \frac{\sqrt{x+h+3}-\sqrt{x+3}}{h}$ (ii) $\lim_{x\to 0} \frac{f(x+h)-f(x)}{h}$ (iii) $\lim_{h\to 0} \frac{1}{\sqrt{x+h+3}+\sqrt{x+3}}$

(iv) $\frac{1}{2\sqrt{x+3}}$ (v) $\lim_{h\to 0} \frac{x+h+3-x+3}{h(\sqrt{x+h+3}+\sqrt{x+3})}$ (vi) $\lim_{h\to 0} \frac{\sqrt{x+3}+h-\sqrt{x+3}}{h}$

(a) (i), (ii), (iii), (iv), and (v) only

(b) (i), (iii), and (iv) only

(c) (i) and (iv) only

(d) (iii), (iv), and (vi) only

(e) (i), (ii), (iii), and (v) only

9. If $xy^3 - 4x^2 + 6y^3 = e^x - 4y$, what is $\frac{dy}{dx}$?

Use implicit diff!

$\frac{d}{dx}(xy^3-4x^2+6y^3)=\frac{d}{dx}(e^x-4y)$

$x\cdot 3y^2\cdot\frac{dy}{dx}+y^3\cdot(1)-8x+18y^2\cdot\frac{dy}{dx}=e^x-4\cdot\frac{dy}{dx}$

$3xy^2\frac{dy}{dx}+18y^2\cdot\frac{dy}{dx}+4\cdot\frac{dy}{dx}=e^x-y^3+8x$

$\frac{dy}{dx}(3xy^2+18y^2+4)=e^x-y^3+8x$

$\boxed{\frac{dy}{dx}=\frac{e^x-y^3+8x}{3xy^2+18y^2+4}}$

(a) $\frac{dy}{dx} = \frac{e^x - 4 + 8x - y^3}{3xy^2 + 18y^2}$

(b) $\frac{dy}{dx} = \frac{e^x + 8x}{3y^2 + 18y^2 + 4}$

(c) $\frac{dy}{dx} = \frac{e^x - 4 + 8x}{3y^2 + 18y^2}$

(d) $\frac{dy}{dx} = \frac{e^x + 8x - y^3}{3xy^2 + 18y^2 + 4}$ (circled)

(e) None of the above

10. If the appropriate u-substitution was made for the integral below, which integral would you obtain?

$\int (15x - 27)(5x^2 - 18x)^{10}\, dx = \int (5x^2-18x)^{10}(15x-27)\,dx$

$u = 5x^2-18x$
$du=(10x-18)\,dx$
$du=2(5x-9)\,dx$
$\frac{1}{2}du=(5x-9)\,dx$

$=\int (5x^2-18x)^{10}\cdot 3(5x-9)\,dx$

$=\int u^{10}\cdot 3\cdot\frac{1}{2}du = \frac{3}{2}\int u^{10}du$

(a) $3\int u^{10}\, du$

(b) $\frac{3}{2}\int u^{10}\, du$ (circled)

(c) $6\int u^{10}\, du$

(d) $\int u^{10}\, du$

(e) None of the above

11. Evaluate the following limit where a is some constant such that $a \neq 3$:

Note: $(\frac{0}{0})$, i.e. indeterminate form. Thus, we algebraically manipulate.

$\lim_{x\to a} \frac{x^2 - a^2}{(x - a)(x - 3)} = \lim_{x\to a}\frac{(x+a)(x-a)}{(x-a)(x-3)} = \lim_{x\to a}\frac{x+a}{x-3} = \frac{a+a}{a-3} = \boxed{\frac{2a}{a-3}}$

(a) 0

(b) $\frac{x+a}{x-3}$

(c) $\frac{1}{a-3}$

(d) $\frac{2a}{a-3}$ (circled)

(e) None of the above

12. Find the equation of the line tangent to the graph of $f(x) = \ln(5 - \sqrt{x})$ at $x = 4$. Round all values to four decimal places.

(a) $y = -0.0833x + 1.4319$

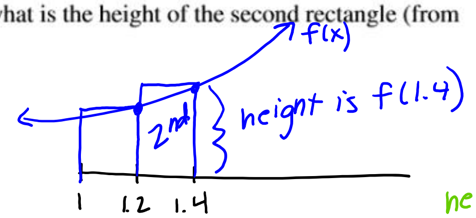
(b) $y = 0.3333x - 0.2347$

(c) $y = -0.0833x$

(d) $y = 0.3333x + 2.4319$

(e) None of the above

13. If a right-hand Reimann sum with 20 subintervals of equal width is used to approximate the area under the curve of $f(x) = 3x^2 + 9$ on the interval from $x = 1$ to $x = 5$, what is the height of the second rectangle (from the left)?



(a) 12.00

(b) 13.32

(c) 14.88

(d) 15.75

(e) None of the above

14. For what values of x is $f(x)$ continuous?

$$f(x) = \begin{cases} \dfrac{x^2 - 4}{x - 2}, & \text{if } x \leq 4 \\ \dfrac{10x + 20}{x + 6}, & \text{if } x > 4 \end{cases}$$

(a) $(-\infty, -6) \cup (-6, 2) \cup (2, 4) \cup (4, \infty)$

(b) $(-\infty, 2) \cup (2, 4) \cup (4, \infty)$

(c) $(-\infty, -6) \cup (-6, 2) \cup (2, \infty)$

(d) $(-\infty, 2) \cup (2, \infty)$

(e) None of the above

15. Given that the domain of $f(x)$ is all real numbers, use the graph of $f'(x)$ below to determine on what interval(s) $f(x)$ is concave down?

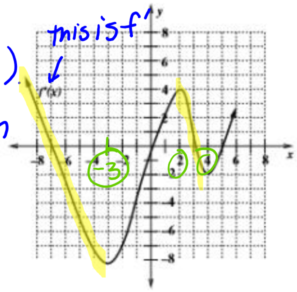
(a) $(-\infty,-7) \cup (0,3) \cup (5,\infty)$

(b) $(-3,2) \cup (4,\infty)$

(c) $(-7,0) \cup (3,5)$

(d) $(-\infty,-3) \cup (2,4)$

(e) None of the above



16. Given the graph of $f(x)$ below and that the area of region A is 2.5, the area of region of B is 4, and the area of region C is 3, what is $\int_{-1}^{4} [2+6f(x)]dx$?

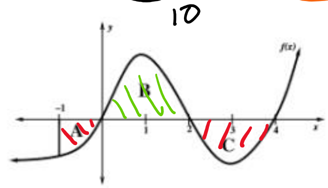
(a) 67

(b) −47

(c) −7

(d) 1

(e) None of the above



17. Given the graph of $f(x)$ below, which of the following statements is FALSE?

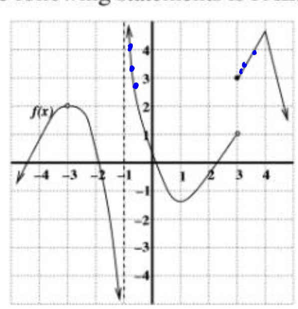
(a) $\lim_{x\to-1^+} f(x) \to \infty$

(b) $\lim_{x\to3^+} f(x) = 3$

(c) $\lim_{x\to-3} f(x)$ does not exist.

(d) $\lim_{x\to3^-} f(x) = 1$

(e) $\lim_{x\to-1^-} f(x) \to -\infty$



18. For what value(s) of x does the line tangent to the graph of $f(x) = \frac{2}{3}x^3 + \frac{9}{2}x^2 - 73x + 65$ have a slope of 8?

   (a) $x = -0.25$
   (b) $x = -111.625$ and $x = 600.5$
   (c) $x = -9$ and $x = 4.5$
   (d) $x = -14.6326$, $x = 0.8283$, and $x = 7.0543$
   (e) None of the above

Slope of tangent line is given by $f'(x)$.
$f'(x) = 2x^2 + 9x - 73$
For what value of x is $f'(x) = 8$?
$2x^2 + 9x - 73 = 8$
$2x^2 + 9x - 81 = 0$
$(2x - 9)(x + 9) = 0$
$2x = 9$; $x = -9$
$x = 4.5$

19. What is the absolute maximum value of $f(x) = \sqrt[3]{9 - x^2}$ $= (9-x^2)^{1/3}$ on $[-1, 4]$? Note: If needed, answer choices are rounded to four decimal places.

   (a) 2
   (b) 2.0801
   (c) -1.9129
   (d) 2.2500
   (e) None of the above

Cont. fcn on closed int ⇒ use the closed interval method.
① Find CV:
$f'(x) = \frac{1}{3}(9-x^2)^{-2/3} \cdot -2x = \frac{-2x}{3(9-x^2)^{2/3}}$
$f'(x) = 0$ when $x = 0$
$f'(x)$ is undefined when $3(9-x^2)^{2/3} = 0$
$9 - x^2 = 0$
$9 = x^2$
$x = -3$, $x = 3$
CV on int. ($x=0$, $x=3$); $x=-3$ not on int.

② make table

x	$f(x)$
-1	2
0	2.0801
3	0
4	-1.9129

20. Suppose that we don't have a formula for $f(x)$ but we know that $f(3) = 7$ and $f'(x) = \sqrt[3]{2x^2 - 10}$ for all x. What is the equation of the line tangent to $f(x)$ at $x = 3$?

   (a) $y = 2x + 1$
   (b) $y = 2x - 11$
   (c) $y = 7x - 19$
   (d) $y = 7x - 11$
   (e) None of the above

① Slope of tangent line is $f'(3) = \sqrt[3]{2(3)^2 - 10} = \sqrt[3]{8} = 2$
② Equation of line $(3, 7)$ $m = 2$
$y - 7 = 2(x - 3)$
$y = 2x - 6 + 7$
$y = 2x + 1$

21. What is the derivative of $f(x)=\dfrac{e^x+x^3-4}{7x-\ln(x)}$?

(a) $f'(x)=\dfrac{(7x-\ln(x))(e^x+3x^2)-(e^x+x^3-4)(7-\ln(x))}{(7x-\ln(x))^2}$

(b) $f'(x)=\dfrac{(e^x+x^3-4)\left(7-\frac{1}{x}\right)-(7x-\ln(x))(e^x+3x^2)}{(7x-\ln(x))^2}$

(c) $f'(x)=\dfrac{e^x+3x^2}{7-\frac{1}{x}}$

(d) $f'(x)=\dfrac{(7x-\ln(x))(e^x+3x^2)-(e^x+x^3-4)\left(7-\frac{1}{x}\right)}{(7x-\ln(x))^2}$

(e) None of the above

$f'(x)=\dfrac{B\cdot T'-T\cdot B'}{B^2}$

$T=e^x+x^3-4$ $\quad B=7x-\ln x$

$T'=e^x+3x^2$ $\quad B'=7-\frac{1}{x}$

$f'(x)=\dfrac{(7x-\ln x)(e^x+3x^2)-(e^x+x^3-4)(7-\frac{1}{x})}{(7x-\ln x)^2}$

22. Given $\int_2^{10} f(x)\,dx=30$, $\int_2^{3} g(x)\,dx=-18$, and $\int_3^{10} g(x)\,dx=7$, what is $\int_2^{10}[3f(x)-2g(x)]\,dx$?

(a) 133

(b) 126

(c) 76

(d) 112

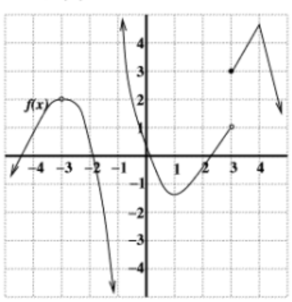
(e) None of the above

$\int_2^{10}[3f(x)-2g(x)]dx = 3\int_2^{10} f(x)dx - 2\int_2^{10} g(x)dx$

$=3(30)-2\left(\int_2^3 g(x)dx+\int_3^{10} g(x)dx\right)$

$=90-2(-18+7)=90-2(-11)=90+22=112$

23. For $f(x)$ below, state the value(s) of x for which the function is NOT continuous.



Where must I pick up my pencil?

$x=-3$ cond. I fails, $f(-3)$ is not defined

$x=-1$ cond. I fails, $f(-1)$ is not defined

$x=3$ cond. II fails, $\lim_{x\to 3} f(x)$ does not exist

(a) $x=-1$ and $x=3$ only

(b) $x=-3$, $x=-1$, and $x=3$ only

(c) $x=-3$, $x=-1$, $x=3$, and $x=4$ only

(d) $x=3$ only

(e) None of the above

24. For $f(x) = \dfrac{1}{8\sqrt[4]{x^3}} + 2^x$, what is $f'(x)$?

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

$f'(x) = \frac{1}{8} \cdot \frac{-3}{4} x^{-7/4} + \ln 2 \cdot 2^x$

$= \frac{-3}{32} x^{-7/4} + \ln 2 \cdot 2^x$

(a) $-6x^{-7/4} + x \cdot 2^{x-1}$

(b) $-\frac{3}{32}x^{1/4} + \cdot 2^x$

(c) $-\frac{3}{32}x^{-7/4} + \ln 2 \cdot 2^x$

(d) $-6x^{1/4} + \ln 2 \cdot 2^x$

(e) None of the above

25. The daily marginal cost function for a local company is given by $M(x) = 2 + 0.02x$ where x represents the number of ladders produced. If we know that it costs \$750 to produce 50 ladders, how much does it cost to produce 80 ladders?

$C'(x)$

$C(80) = ?$

① $C(x) = \int C'(x)\,dx = \int (2 + 0.02x)\,dx$

$= 2x + \frac{0.02}{2}x^2 + C_1$

② Use $C(50) = 750$ to solve for C_1

$750 = 2(50) + 0.01(50)^2 + C_1$

$625 = C_1$

③ $C(x) = 2x + 0.01x^2 + 625$

④ Find $C(80) = 2(80) + 0.01(80)^2 + 625$

$= \$849$

(a) \$224

(b) \$849

(c) \$874

(d) \$819

(e) None of the above

26. The table below represents the position of a particle (in meters) after t seconds.

t	0	1	2	3	4
$s(t)$	0	10	15	17	20

What is the average velocity (in meters/second) of the particle over the time period $[2,4]$?

Avg vel $= \dfrac{s(4) - s(2)}{4 - 2} = \dfrac{20 - 15}{2} = \dfrac{5}{2} = 2.5\text{ m/s}$

(a) 5

(b) 2.5

(c) 2

(d) 3

(e) None of the above

27. Let $h(x) = \dfrac{f(x^3)}{g(x)}$. If $f(3) = 1$, $f'(3) = -2$, $g(3) = 4$, $g'(3) = -5$, $f(27) = -1$, and $f'(27) = 6$, what is $h'(3)$?

$h'(x) = \dfrac{g(x) \cdot f'(x^3) \cdot 3x^2 - f(x^3) \cdot g'(x)}{(g(x))^2}$

(a) 19/16

(b) −162/5

(c) −6/5

(d) 643/16

(e) None of the above

$h'(3) = \dfrac{g(3) \cdot f'(3^3) \cdot 3 \cdot 3^2 - f(3^3) \cdot g'(3)}{(g(3))^2} = \dfrac{(4)(6)(27) - (-1)(-5)}{4^2} = \boxed{\dfrac{643}{16}}$

28. The price-demand function for a particular product is $p(x) = 522 - 4x$ where $p(x)$ is the unit price when x units are demanded. The company making the product has a cost function of $C(x) = 42x + 13400$ where x is the number of items made and sold. Find the number of items the company must make and sell in order to maximize its profits.

$x \geq 0$, $p \geq 0$
$522 - 4x \geq 0$
$-4x \geq -522$
$x \leq 130.5$
$[0, 130.5]$

① Find the revenue function:
$R(x) = x \cdot p(x)$
$R(x) = x(522 - 4x)$
$R(x) = 522x - 4x^2$

③ Solve optimization problem:
Maximize $P(x) = -4x^2 + 480x - 13400$ on $[0, 130.5]$

(a) 46 items

(b) 60 items

(c) 80 items

(d) 74 items

(e) None of the above

$P'(x) = -8x + 480$
$P'(x) = 0$ when $-8x + 480 = 0$, $-8x = -480$, $x = 60$

② Find the profit function
$P(x) = R(x) - C(x)$
$= 522x - 4x^2 - (42x + 13400)$
$= 480x - 4x^2 - 13400 = -4x^2 + 480x - 13400$

$P''(x) = -8$
$P''(60) = - \Rightarrow \cap \Rightarrow$ Abs Max at 60 items

29. Suppose the number of students admitted into a program at Texas A&M can be modeled by

$$A(t) = \frac{227}{1 + 7e^{-0.6t}}$$

where t is the number of years since 1992. Find the average rate of change of the number of students admitted from 1996 to 2000. Answers are given to four decimal places.

$t = 4$ $t = 8$

(a) 8.1437 students/year

(b) 32.5749 students/year

(c) 75.7995 students/year

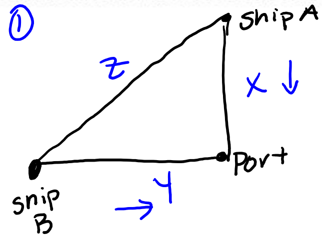
(d) 18.9499 students/year

(e) None of the above

$\dfrac{A(8) - A(4)}{8 - 4} \approx \dfrac{214.6352436582 - 138.835740468 77}{4} \approx 18.9499$ students/year

30. A ship is observed to be 5 miles due north of port and travelling due south at 2 miles per hour. At the same time, another ship is observed to be 12 miles due west of port and travelling due east on its way back to port at 3 miles per hour. What is the rate at which the distance between the ships is changing?

(a) -2 miles per hour
(b) $-\frac{46}{13}$ miles per hour
(c) $\frac{46}{13}$ miles per hour
(d) $\frac{13}{17}$ miles per hour
(e) None of the above



① ② $x = 5$ miles, $\frac{dx}{dt} = -2$ m/hr, $y = 12$ miles, $\frac{dy}{dt} = -3$ m/hr, $\frac{dz}{dt} = ?$

③ $x^2 + y^2 = z^2$

④ $2x\cdot\frac{dx}{dt} + 2y\cdot\frac{dy}{dt} = 2z\cdot\frac{dz}{dt}$

$2(5)(-2) + 2(12)(-3) = 2(13)\cdot\frac{dz}{dt}$

$-92 = 26\cdot\frac{dz}{dt}$

$-\frac{46}{13}$ mph $= \frac{dz}{dt}$

We still need z:
$5^2 + 12^2 = z^2$
$25 + 144 = z^2$
$169 = z^2$
$z = 13$ → $z = 13$ miles

31. Evaluate the following integral:

$$\int \frac{5x^2 - 2\sqrt{x} - 3}{\sqrt[6]{x}}\,dx$$

(a) $5x^{11/6} - 2x^{1/3} - 3x^{-1/6} + C$
(b) $\frac{30}{17}x^{17/6} - \frac{3}{2}x^{4/3} - \frac{18}{5}x^{5/6} + C$
(c) $\frac{55}{6}x^{5/6} - \frac{2}{3}x^{-2/3} + \frac{1}{2}x^{-7/6} + C$
(d) $(\frac{5}{3}x^3 - \frac{4}{3}x^{3/2} - 3x)\cdot\frac{6}{5}x^{5/6} + C$
(e) None of the above

$= \int \left(\frac{5x^2}{x^{1/6}} - \frac{2x^{1/2}}{x^{1/6}} - \frac{3}{x^{1/6}}\right)dx$

$= \int (5x^{11/6} - 2x^{1/3} - 3x^{-1/6})\,dx$

$= 5\cdot\frac{6}{17}x^{17/6} - 2\cdot\frac{3}{4}x^{4/3} - 3\cdot\frac{6}{5}x^{5/6} + C$

$= \frac{30}{17}x^{17/6} - \frac{3}{2}x^{4/3} - \frac{18}{5}x^{5/6} + C$

32. Evaluate the following: $\lim\limits_{x\to\infty} \frac{2e^{-x} + 3 - 5e^{4x}}{3e^{4x}}$

(a) ∞
(b) 0
(c) 2/3
(d) $-5/3$
(e) None of the above

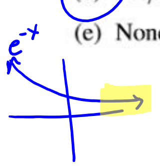
*since x is approaching + infinity, we divide by the most pos. e^{nx} in the denom.

$= \lim\limits_{x\to\infty} \frac{\frac{2e^{-x}}{e^{4x}} + \frac{3}{e^{4x}} - \frac{5e^{4x}}{e^{4x}}}{\frac{3e^{4x}}{e^{4x}}} = \lim\limits_{x\to\infty} \frac{2e^{-5x} + 3e^{-4x} - 5}{3}$

$\lim\limits_{x\to\infty}(2e^{-5x} + 3e^{-4x} - 5) = -5$

$\lim\limits_{x\to\infty}(3) = 3$

Thus, $\lim\limits_{x\to\infty} \frac{2e^{-x} + 3 - 5e^{4x}}{3e^{4x}} = \boxed{-\frac{5}{3}}$



33. The price-demand function for a particular product is $p(x) = 508 - 5x$ where $p(x)$ is the unit price when x units are demanded. Use the marginal revenue function to approximate the revenue from selling the 22^{nd} item.

(a) \$298

(b) \$278

(c) \$303

(d) \$288

(e) None of the above

34. A Riemann Sum with 4 subintervals of equal width and heights chosen to be the left endpoint of each subinterval is used to approximate $\int_2^{10} (3x^2 + 7x - 4)\,dx$. What is the area of the third rectangle? Note: I am referring to the third rectangle when counting the rectangles from left to right.

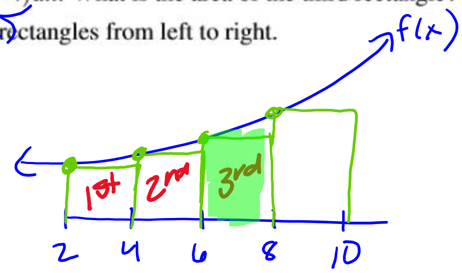
(a) 292

(b) 244

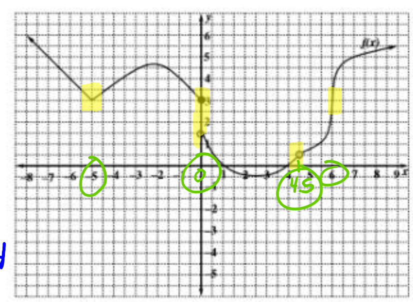
(c) 488

(d) 146

(e) None of the above



35. Given the graph of $f(x)$ below, for what value(s) of x is $f(x)$ non-differentiable?



(a) $x = 0$ and $x = 4.5$ only

(b) $x = -5$, $x = 0$, $x = 4.5$, and $x = 6$ only

(c) $x = -5$, $x = 0$, and $x = 4.5$ only

(d) $x = -5$ and $x = 6$ only

(e) None of the above

36. Given $f(x)$ is continuous over $(-\infty,8)\cup(8,\infty)$ and $f'(x)=\dfrac{(x-3)(x+4)}{(x-8)^4}$. Which one of the following is FALSE?

(a) $f(-4)$ is a local max T

(b) $f(3)$ is a local min T

(c) $f(8)$ is a local max F

(d) $f(x)$ is decreasing on $(-4,3)$ T

(e) The critical values of $f(x)$ are $x=-4$ and $x=3$. T

Create sign chart for $f'(x)$:
$f'(x)=0$ when $x=3$, $x=-4$
$f'(x)$ DNE when $x=8$

f: ↗ ↘ ↗ ↘
f': + − + +
$x=-5$, -4 (CV), $x=0$, 3 (CV), $x=5$, 8, $x=10$
8: not in domain of f.

37. Given that the domain of $f(x)$ is all real numbers, use the graph of $f'(x)$ below to determine on what interval(s) $f(x)$ is increasing?

(a) $(-\infty,-7)$ [redacted] $(0,3)$ [redacted] $(5,\infty)$

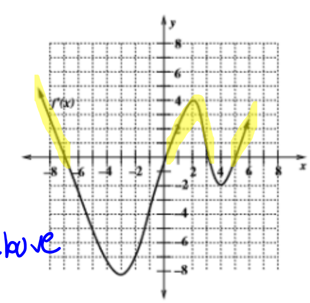
(b) $(-3,2)$ [redacted] $(4,\infty)$

(c) $(-7,0)$ [redacted] $(3,5)$

(d) $(-\infty,-3)$ [redacted] $(2,4)$

(e) None of the above

f	↗	↘	∪	∩
f'	+	−	↗	↘
f''			+	−



f is increasing when f' is positive (i.e. above the x-axis)
$\Rightarrow (-\infty,-7),(0,3),(5,\infty)$

38. Evaluate $\int_1^b \left(4x^2 - e^x + \frac{1}{x}\right) dx$

(a) $\frac{4}{3}b^3 - e^b + \ln|b| - \frac{4}{3} - e$

(b) $\frac{4}{3}b^3 - e^b + \ln|b| - \frac{4}{3} + e$

(c) $\frac{4}{3} - e - \frac{4}{3}b^3 - e^b + \ln|b|$

(d) $\frac{4}{3} - e - \frac{4}{3}b^3 + e^b - \ln|b|$

(e) None of the above

39. Find $f''(x)$ if $f(x) = \dfrac{2x^2 + 3x^5 - 4x\ln x}{x}$.

(a) $f''(x) = 4x + 15x^4 - 4(1 + \ln x)$

(b) $f''(x) = \dfrac{x\left(4x + 15x^4 - \frac{4}{x}\right) - (2x^2 + 3x^5 - 4x\ln x)}{x^2}$

(c) $f''(x) = 36x^2 + \dfrac{4}{x^2}$

(d) $f''(x) = 2 + 12x^3 - \dfrac{4}{x}$

(e) None of the above

40. The graph below is of $f'(x)$. If $f(2) = 3$, what is $f(6)$?

(a) -2

(b) 1

(c) 4

(d) 7

(e) None of the above