Math 1A

Final Exam - Review

Part 1: A calculator may not be used on this exam.

1. Evaluate $\lim_{x\to 0} \dfrac{1-\cos^2 x}{x \sin 2x}$.

A) 0 B) $\frac{1}{2}$ C) 1 D) 2 E) 3

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2. If $f(x) = \pi - \sin x + (\pi x)$, then $f'(\pi) =$

A) $\frac{\pi}{2}$ B) $\frac{4}{\pi}$ C) $\pi + 1$ D) $\pi - 1$ E) 2π

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3. Find the domain of the function $f(x) = \ln(3x+1)$.

A) $x \in (-\infty, \infty)$ B) $x \in (-\frac{1}{3}, \infty)$ C) $x \in (0, \infty)$

D) $x \in (\frac{1}{3}, \infty)$ E) $x \in (-\frac{1}{3}, \frac{1}{3})$

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4. Evaluate the indefinite integral: $\displaystyle\int \frac{x}{(x+2)^{2/3}}\,dx$

A) $\frac{3}{4}(x+2)^{1/3}(x+2) + C$ B) $\frac{3}{4}(x+2)^{2/3} + 9(x+2)^{1/6} + C$

C) $3(x+2)^{1/3} + C$ D) $\frac{3}{4}(x+2)^{4/3} - 6(x+2)^{1/3} + C$

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

5. For what value(s) of x does the function defined by $f(x) = \dfrac{x^2 - 6x + 8}{x^2 - 2x - 8}$ have an undefined discontinuity?

A) $x = 2$ only B) $x = -4$ only C) $x = 4$ only

D) $x = 4$ and $x = -2$ E) $x = -4$ and $x = 2$

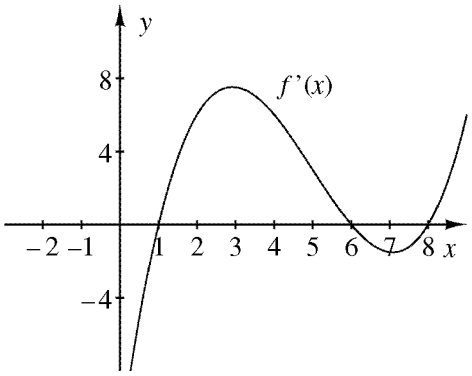
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6. An object moves along the x-axis so that its velocity at any time $t \geq 0$ is given by $v(t) = 4t^3 - 4t$. Find the total distance traveled for the particle from $t = 0$ to $t = 2$.

A) 0 B) 8 C) 9 D) 10 E) 12

---

7. The figure below is the graph of the derivative of the function $f(x)$. What interval(s) is $f(x)$ increasing?



A) $(1, 6)$ or $(8, +\infty)$ B) $(-1, 6)$ C) $(-\infty, 2)$ or $(8, +\infty)$

D) $(8, +\infty)$ E) $(-\infty, 1)$ or $(6, 8)$

8. Evaluate the following limit:

$$\lim_{x \to 0} \frac{e^{3x} - 1 - 3x}{x^2}$$

A) 0 B) $\frac{9}{2}$

C) 3 D) $\frac{3}{2}$

E) The limit does not exist.

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9. f and g are differentiable functions and have the values shown in the table.

If $A = \sqrt{f(x)}$ then $A'(-2) =$

A) 1 B) $\frac{9}{4}$ C) $\frac{8}{9}$ D) 3 E) $\frac{9}{8}$

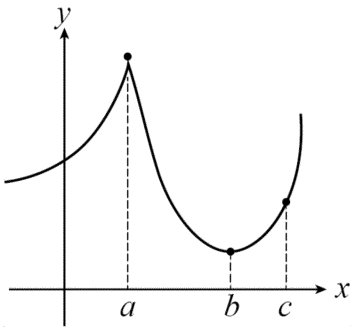
x	f	f'	g	g'
-8	4	3	-2	6
-6	10	12	0	9
-2	16	9	6	18
2	30	11	12	24

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10. Evaluate $\lim_{h \to 0} \dfrac{\dfrac{1}{(x+h)^2} - \dfrac{1}{x^2}}{h}$.

A) $\frac{1}{x^3}$ B) $-2x^3$ C) $-\frac{2}{x^3}$ D) $\frac{2}{x^2}$ E) $-\frac{1}{x^3}$

11.



Which of the following tables best goes with the graph of f shown?

A)

x	$f'(x)$
a	0
b	0
c	4

B)

x	$f'(x)$
a	0
b	0
c	-2

C)

x	$f'(x)$
a	Does Not Exist
b	0
c	6

D)

x	$f'(x)$
a	Does Not Exist
b	Does Not Exist
c	-1

E)

x	$f'(x)$
a	6
b	0
c	-2

---

12. Evaluate the definite integral:

$$\int_0^1 x^2 e^{x^3+1}\,dx$$

A) $\frac{1}{3}(e^2 - e)$ B) $\frac{1}{3}(e^2 - 1)$ C) $e^2 - e$ D) $\frac{1}{3}e^2$ E) $3(e^2 - e)$

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13. Find the particular solution $f(x)$ of the equation $f'(x) = 4x^{-1/2}$ that satisfies the condition $f(1) = 12$.

A) $f(x) = 8\sqrt{x} + C$ B) $f(x) = 2\sqrt{x} + 10$ C) $f(x) = \frac{1}{2}\sqrt{4x} + 11$

D) $f(x) = 8\sqrt{x} + 4$ E) $f(x) = 4\sqrt{x} + 8$

14. Find the given antiderivative: $\int (x+1)\sqrt{x}\,dx$

A) $\frac{1}{5}x^{\frac{5}{3}} - \frac{3}{2}x^{\frac{2}{3}} + C$

B) $-\frac{5}{2}x^{\frac{2}{5}} + \frac{3}{2}x^{\frac{2}{3}} + C$

C) $\frac{2}{5}x^{\frac{5}{2}} + \frac{2}{3}x^{\frac{3}{2}} + C$

D) $\frac{2}{5}x^2 + \frac{2}{3}x^3 + C$

E) $-\frac{1}{2}x^{\frac{1}{2}} + \frac{1}{3}x^{\frac{1}{3}} + C$

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15. Given $f(x) = \dfrac{x}{x^2+1}$, find the x-coordinate(s) of the points of inflection on the graph of $f(x)$.

A) $x = 1$ only

B) $x = 0$ only

C) $x = \sqrt{3}$ and $x = -\sqrt{3}$

D) $x = \sqrt{3}$, $x = -\sqrt{3}$, and $x = 0$

E) $x = 0$ and $x = \sqrt{3}$

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16. Find an equation of the tangent line to the graph of $f(x) = \dfrac{x-3}{x+3}$ when $x = -2$.

A) $y + 5 = 6(x+2)$

B) $y - 5 = 6(x+2)$

C) $y - 5 = -6(x-2)$

D) $y + 5 = -6(x-2)$

E) $y - 5 = 3(x+2)$

---

17. Evaluate $\displaystyle\int \frac{\sin(\ln x)}{x} dx$.

A) $-\cos(\ln x) + C$

B) $\sin(\ln x) + C$

C) $\cos(\ln x) + C$

D) $\tan(\ln x) + C$

E) $-\sin(\ln x) + C$

18. Which of the following functions are continuous for all real numbers x?

I. $y = \dfrac{x^2+5}{x^2+2}$

II. $y = \dfrac{3}{x^2}$

III. $y = |2x-7|$

A) I and III only B) I only C) III only

D) I and II only E) II and III only

---

19. At what point on the graph of $y = \dfrac{1}{2}x^2$ is the tangent line parallel to the line $2x - 4y = 3$?

A) $\left(\dfrac{1}{2}, -\dfrac{1}{2}\right)$ B) $\left(1, -\dfrac{1}{4}\right)$ C) $\left(1, \dfrac{1}{2}\right)$ D) $\left(\dfrac{1}{2}, \dfrac{1}{8}\right)$ E) $(2, 2)$

---

20. If $g(x) = \displaystyle\int_{-2}^{x^4} (t-5)\,dt$, apply the chain rule to the Fundamental Theorem of Calculus Part 1 to determine $\dfrac{d}{dx}[g(x)]$.

A) $x-5$ B) $4x^3(x^4-5)$ C) $4t^3(t^4-5)$ D) -112 E) $4t-20$

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21. For what x-coordinate(s) does the function defined by $f(x) = x^{2/3}(x^2-4)$ have a relative minimum?

A) $x = 1$ and $x = -1$ B) $x = 1$ only C) $x = -1$ only

D) $x = 0$ only E) $x = -2$ and $x = 0$

22. If $f(x) = \sqrt{x+1}$, then by definition $f'(x)$ is represented by:

A) $\lim_{h\to 0} \dfrac{\sqrt{h+1}-1}{h}$

B) $\lim_{h\to 0} \dfrac{\sqrt{x+h}-\sqrt{x+1}}{h}$

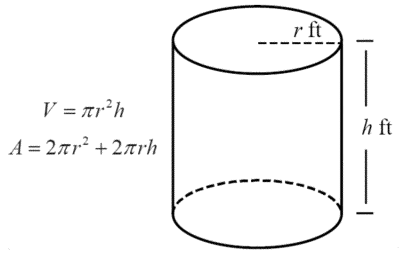
C) $\lim_{h\to 0} \dfrac{\sqrt{x+h+1}-\sqrt{h+1}}{h}$

D) $\lim_{h\to 0} \dfrac{\sqrt{x+h+1}-\sqrt{x+1}}{h}$

E) $\lim_{h\to 0} \dfrac{\sqrt{x+h+1}-\sqrt{x+h}}{h}$

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23. You have been asked to design a 150 cm^3 container shaped like a right circular cylinder, see figure below. What is the objection function you will use to determine the least amount of material needed to construct the container?



A) $A(r) = \dfrac{2\pi r^2 + 300\pi}{r}$

B) $A(r) = \dfrac{2\pi r^3 + 300}{r^2}$

C) $A(r) = \dfrac{2\pi r^3 + 300\pi}{r}$

D) $A(r) = \dfrac{2\pi r^3 + 300r}{\pi r}$

E) $A(r) = \dfrac{2\pi r^3 + 300}{r}$

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24. Let f be the function defined by $f(x) = 4x^3 - 5x + 3$. Which of the following is an equation of the normal line to the graph of $f(x)$ at the point where $x = -1$?

A) $y + 4 = -\dfrac{1}{7}(x-1)$

B) $y - 4 = 7(x+1)$

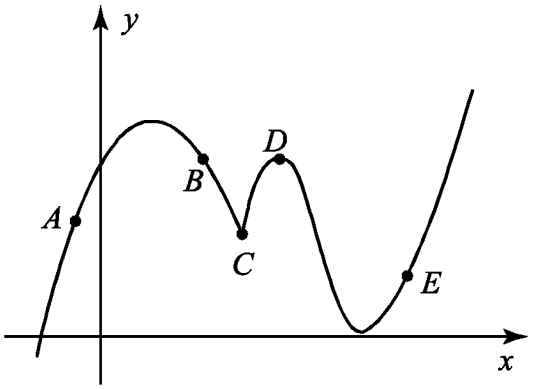
C) $y - 4 = -\dfrac{1}{7}(x+1)$

D) $y - 4 = \dfrac{1}{7}(x+1)$

E) $y + 4 = \dfrac{1}{7}(x-1)$

25. At which point on the graph of $y = f(x)$, show below, is $\dfrac{dy}{dx} > 0$ and $\dfrac{d^2y}{dx^2} < 0$?

A) A B) B C) C D) D E) E



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26. The figure shows the graph of f', the derivative of the function f. For what value(s) is the graph of f concave upwards?

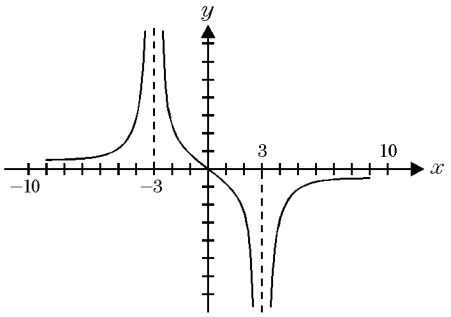
A) $-3 < x < 10$ only

B) $3 < x < +\infty$ only

C) $-3 < x < 3$ only

D) $-\infty < x < -3$ and $3 < x < +\infty$

E) $-3 < x < 0$ and $3 < x < +\infty$



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27. $\lim\limits_{x \to 0^+} \dfrac{2x+1}{x}$ is

A) $-\infty$ B) 0 C) -2 D) 2 E) $+\infty$

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28. Integrate: $\displaystyle\int (2 + \sin 3t)^{\frac{1}{2}} \cos 3t \, \mathrm{dt}$

A) $-\dfrac{1}{2}(\cos 3t + 2)^{\frac{1}{2}} + C$ B) $\dfrac{2}{9}(\sin 3t + 2)^{\frac{3}{2}} + C$ C) $-\dfrac{1}{3}(\sin 3t + 2)^{\frac{1}{3}} + C$

D) $-\dfrac{1}{3}(\sin 3t + 2)^{\frac{3}{2}} + C$ E) $\dfrac{2}{9}(\cos 3t + 2)^{\frac{3}{2}} + C$

29. If $f(x) = \ln(\sin x)$, then $f''(x) =$

A) $\sin^2 x - 1$ B) $\sin^2 x + 1$ C) $-\cot^2 x - 1$ D) $-\cot^2 x + 1$ E) $\tan^2 x - 1$

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30. What is the slope of the tangent line to $xy + 2xy^3 = 6$ at the point $(2, 1)$?

A) $-\frac{3}{14}$ B) $\frac{14}{3}$ C) $\frac{3}{14}$ D) 6 E) $-\frac{14}{3}$

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31. What is the slope of the line tangent to the curve $3y^2 - 2x^2 = 6 - 2xy$ at the point $(3,\ 2)$?

A) 0 B) $\frac{4}{9}$ C) $\frac{7}{9}$ D) $\frac{6}{7}$ E) $\frac{5}{3}$

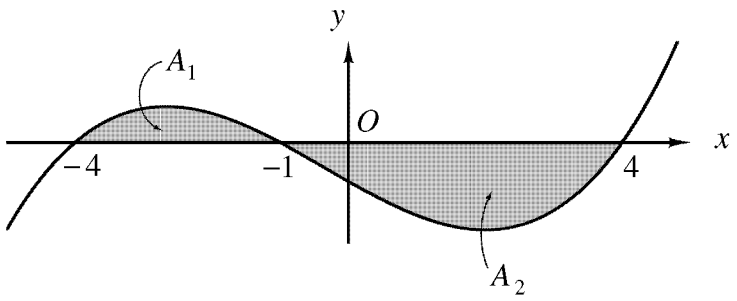
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32. A particle moves along a straight line with a velocity given by $v(t) = 3t^2 - 4t + 5$ for $t \geq 0$, where t is measured in seconds and velocity in meters per second. If the particle's initial position is $s(0) = 4$ meters, which of the following represents the position function $s(t)$?

A) $s(t) = t^3 - 2t^2 + 5t + 4$ B) $s(t) = 6t - 4$ C) $s(t) = t^3 - 2t^2 + 5t$

D) $s(t) = 3t^3 - 2t^2 + 5t + 4$ E) $s(t) = t^3 - 4t^2 + 5t + 4$

33. The graph of $y = f(x)$ is shown in the figure below. If A_1 and A_2 are positive numbers that represent the areas of the shaded regions, then in terms of A_1 and A_2, evaluate $3\int_{-4}^{4} f(x)\,dx - 2\int_{-1}^{4} f(x)\,dx =$



A) $A_1 + A_2$ B) $2A_1 + A_2$ C) $3A_1 - A_2$ D) $2A_1 - 3A_2$ E) $A_1 - 3A_2$

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34. A stone dropped in a still pond creates a circular ripple whose radius increases at a constant rate of 3 ft/s. At what rate is the area enclosed by the ripple increasing 8 seconds after the stone strikes the pond? (Area of a circle is $A = \pi r^2$.)

A) $48\pi\,\text{ft}^2/\text{s}$ B) $64\pi\,\text{ft}^2/\text{s}$ C) $84\pi\,\text{ft}^2/\text{s}$ D) $128\pi\,\text{ft}^2/\text{s}$ E) $144\pi\,\text{ft}^2/\text{s}$

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35. Evaluate $\lim_{x\to 0} \dfrac{\sin(\sin x)}{\sin x}$.

A) 1 B) $\dfrac{\pi}{2}$ C) π

D) 2π E) Does Not Exist

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36. Find $\dfrac{d^2y}{dx^2}$ for $y = \dfrac{1-x}{x-3}$.

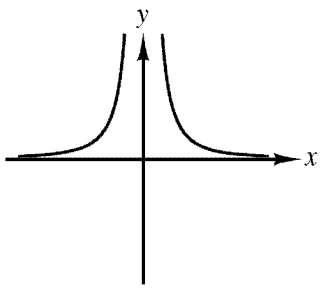
A) 0 B) $\dfrac{-8}{(x-3)^3}$ C) $\dfrac{-4}{(x-3)^3}$ D) $\dfrac{8}{(x-3)^3}$ E) $\dfrac{2}{(x-3)^2}$

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37. If $f(x) = x^2e^{-4x}$ find a point of tangency where the tangent is horizontal.

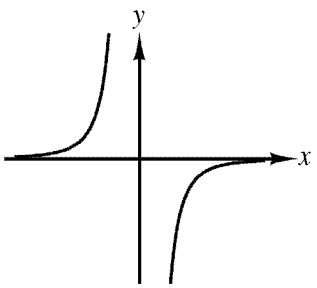
A) $(0,1)$ B) $\left(\dfrac{1}{2}, e^2\right)$ C) $\left(-2, \dfrac{4}{e^2}\right)$ D) $(2, e^2)$ E) $\left(\dfrac{1}{2}, \dfrac{1}{4e^2}\right)$

38.

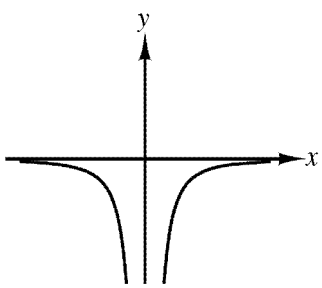


Match the function $f(x)$ above with the graph of its derivative below.

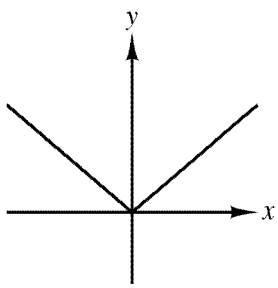
A)



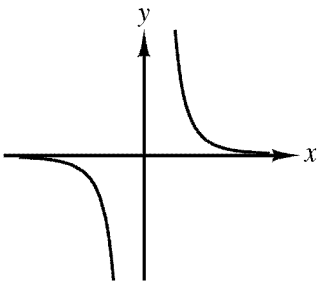
B)



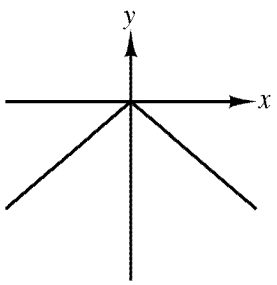
C)



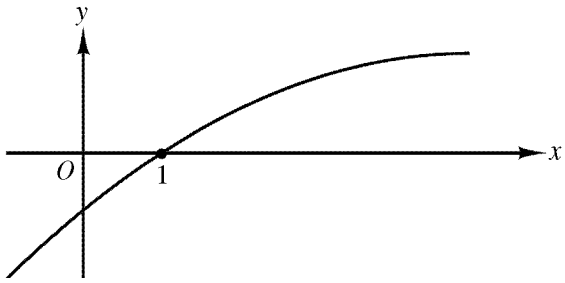
D)



E)



39.



The graph of a twice-differentiable function f is shown in the figure above. Which of the following is true?

A) $f(1) < f'(1) < f''(1)$

B) $f(1) < f''(1) < f'(1)$

C) $f'(1) < f(1) < f''(1)$

D) $f''(1) < f(1) < f'(1)$

E) $f''(1) < f'(1) < f(1)$

40. Find the x-coordinate of the relative maximum or relative minimum point of the function $f(x) = x^{1/3}(9 - x)$.

A) $\frac{1}{4}$ maximizer B) $\frac{1}{4}$ minimizer C) $\frac{9}{4}$ minimizer

D) $\frac{9}{4}$ maximizer E) No extrema

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41. A particle moves in a straight line from its initial position so that after t seconds, its distance is given by $s(t) = \dfrac{t}{t+2}$ feet from its initial position. Find the instantaneous velocity of the particle at $t = 2$ seconds.

A) $\dfrac{1}{8}$ ft/sec B) $\dfrac{3}{32}$ ft/sec C) $\dfrac{5}{8}$ ft/sec D) $\dfrac{1}{2}$ ft/sec E) $\dfrac{1}{10}$ ft/sec

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42. A solid has a base bounded by $x^2 + y^2 = 25$. Find the volume of the solid if every plane section perpendicular to the x-axis is an equilateral triangle.

A) 250 units^3 B) 500 units^3 C) $\dfrac{500\pi\sqrt{3}}{3}$ units^3

D) $\dfrac{500\sqrt{3}}{3}$ units^3 E) $\dfrac{250\sqrt{3}}{3}$ units^3

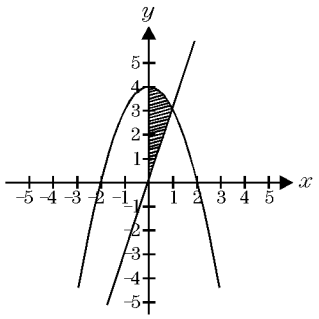
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43. If $f(x) = x \ln x^3$ then $f'(e) =$

A) $\dfrac{e}{2}$ B) 6 C) 12 D) e E) $6e$

44. Let R be a region in the first quadrant enclosed by the curves of $y = 4 - x^2$, $y = 3x$, and the y-axis. Find the area of the enclosed region.

A) $\frac{6}{13}$ B) $\frac{1}{2}$ C) $\frac{13}{6}$ D) 4 E) 13



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

A) $y = 0$ only B) $x = 0$, $x = 4$, and $y = 0$ C) $x = 0$, and $x = 4$

D) $x = 0$, $x = 4$, and $y = x$ E) $x = 0$, and $y = 0$

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46. Find all intervals on which the function $y = 6x^3 - x^4$ is concave upward.

A) $x \in (-\infty, 0) \cup (3, \infty)$ B) $x \in (-\infty, 0) \cup (6, \infty)$ C) $x \in (-\infty, 3) \cup (6, \infty)$

D) $x \in (0, 3)$ E) $x \in (3, 6)$

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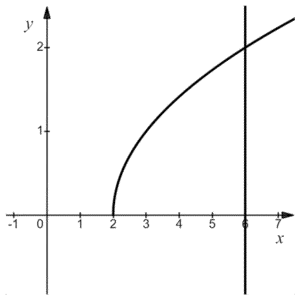
47. If $f(x) = (9 - x^2)^{3/5}$, find all critical numbers for $f'(x)$.

A) $x = 0$ only B) $x = 3$ only

C) $x = 0$ and $x = 3$ D) $x = -3$ and $x = 3$

E) $x = -3$, $x = 0$, and $x = 3$

48. The first quadrant region bounded by $y = \sqrt{x-2}$ and $x = 6$ is revolved about the x-axis. Determine the volume of the solid of revolution.



A) $\dfrac{9\pi}{2}$ B) 4π C) $\dfrac{2\pi}{3} + 8$ D) 6π E) 8π

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49. Find the derivative of $f(x) = \dfrac{x(x^2+2)}{\sqrt{x^3-7}}$ using logarithmic differentiation.

A) $f'(x) = \dfrac{x(x^2+2)}{\sqrt{x^3-7}} \cdot \left[\dfrac{x^2+2}{x} + \dfrac{2x^2}{x^2+2} + \dfrac{3x^2}{2(x^3-7)}\right]$

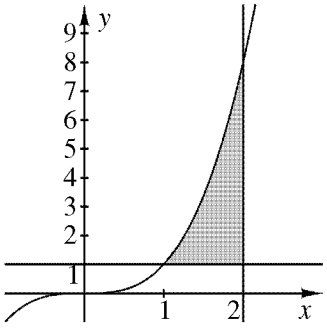
B) $f'(x) = \dfrac{x(x^2+2)}{\sqrt{x^3-7}} \cdot \left[\dfrac{1}{x} + \dfrac{2x}{x^2+2} - \dfrac{3x^2}{2(x^3-7)}\right]$

C) $f'(x) = \dfrac{x(x^2+2)}{\sqrt{x^3-7}} \cdot \left[\dfrac{x^2+2}{x} + \dfrac{2x^2}{x^2+2} - \dfrac{3x^2}{2(x^3-7)}\right]$

D) $f'(x) = \dfrac{x(x^2+2)}{\sqrt{x^3-7}} \cdot \left[\dfrac{1}{x} + \dfrac{2x}{x^2+2} + \dfrac{3x^2}{2(x^3-7)}\right]$

E) $f'(x) = \dfrac{x(x^2+2)}{\sqrt{x^3-7}} \cdot \left[\dfrac{1}{x} - \dfrac{2x}{x^2+2} + \dfrac{3x^2}{2(x^3-7)}\right]$

50. Which of the following integrals represents the volume of the solid formed by revolving the region bounded by $y = x^3$, $y = 1$, and $x = 2$ about the line $x = 2$? (See figure below.)



A) $2\pi \int_1^8 (3 - y)(\sqrt[3]{y} - 1)\, dy$

B) $2\pi \int_1^2 (2 - x)(x^3 - 1)\, dx$

C) $\pi \int_1^2 \left[(x^3 - 1)^2 - 1^2\right]\, dx$

D) $\pi \int_1^8 \left[(\sqrt[3]{y})^2 - 1^2\right]\, dy$

E) $\pi \int_1^2 \left[x^3 - 3\right]^2\, dx$

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1.
Answer: B

2.
Answer: C

3.
Answer: B

4.
Answer: D

5.
Answer: C

6.
Answer: D

7.
Answer: A

8.
Answer: B

9.
Answer: E

10.
Answer: C

11.
Answer: C

12.
Answer: A

13.
Answer: D

14.
Answer: C

15.
Answer: D

16.
Answer: A

17.
Answer: A

18.
Answer: A

19.
Answer: D

20.
Answer: B

21.
Answer: A

22.
Answer: D

23.
Answer: E

24.
Answer: C

25.
Answer: A

26.
Answer: D

27.
Answer: E

28.
Answer: B

29.
Answer: C

30.
Answer: A

31.
Answer: B

32.
Answer: A

33.
Answer: C

34.
Answer: E

35.
Answer: A

36.
Answer: C

37.
Answer: E

38.
Answer: A

39.
Answer: D

40.
Answer: D

41.
Answer: A

42.
Answer: D

43.
Answer: B

44.
Answer: C

45.
Answer: B

46.
Answer: D

47.
Answer: E

48.
Answer: E

49.
Answer: B

50.
Answer: B