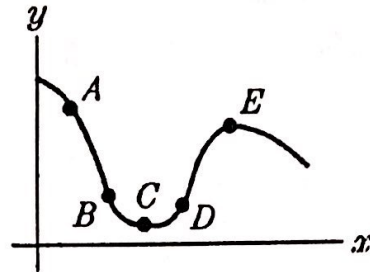ame: _____   Date: _____

The table shows the position of an object moving along a line at 10 second intervals.

Estimate the velocity, in units/sec, at $t = 15$.

t (sec)	0	10	20	30	40
position	4	12	26	44	68

A. 0.140

B. −1.400

C. 0.714

D. 1.400

2. At which of the five points shown on the graph is $\frac{dy}{dx}$ positive? Choose the *best* answer.
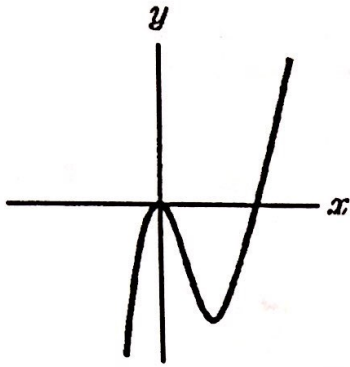

A. A and E

B. D only

C. C, D, and E

D. E only

3. At which of the five points shown on the graph is $\frac{d^2y}{dx^2}$ positive? Choose the *best* answer.
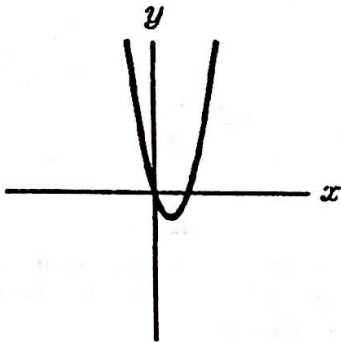
A. A and E

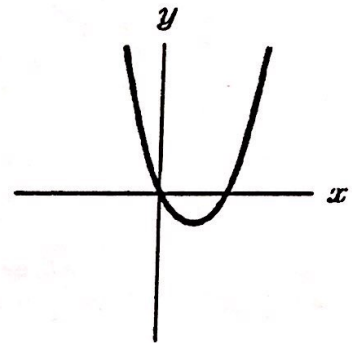B. B and D

C. C only

D. B, C, and D

4.

Given the graph of f, which of the following is the graph of the derivative, f'?
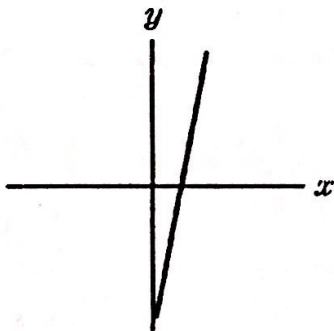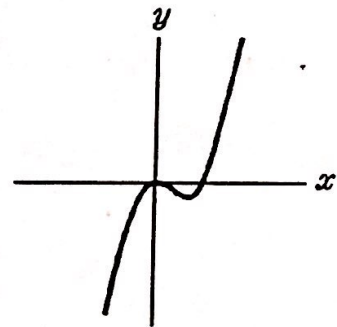
A.

B.

C.

D.

Which of the following tables goes best with the graph of f?
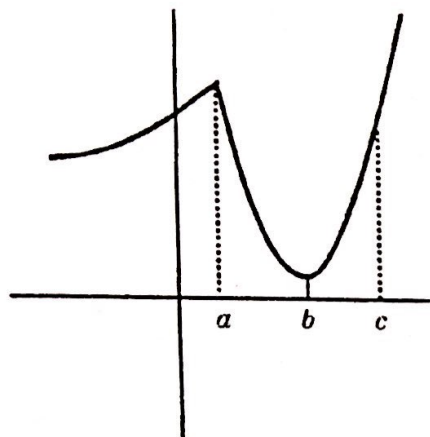
A.

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	6.2

D.

x	$f'(x)$
a	does not exist
b	does not exist
c	-1

6. Let f be defined by $f(x) = x^2(x-3)$ for all real numbers x. For what values of x is the function increasing?

A. $0 < x < 2$

B. $0 < x < 3$

C. $-\infty < x < 0$ and $x > 2$

D. $-\infty < x < \infty$

7. If $f(x) = -x^3 + 12x^2 - 36x + 9$, which of the following statements is true?

A. f is decreasing on $(2, 6)$

B. f is increasing on $(6, \infty)$

C. f is increasing on $(2, 6)$

D. f is decreasing for all real values

8. Over which interval(s) is $f(x) = \dfrac{x^2}{x^2 + 4}$ is increasing?

A. $(0, \infty)$

B. $(-\infty, 0)$

C. $(-\infty, \infty)$

D. $(-\infty, 0)$ and $(2, \infty)$

9. Let $f(x) = \frac{1}{2}\sin 2x$ for $0 \le x < 2\pi$. Over what interval is the function decreasing?

A. $0 < x < \frac{\pi}{2}$ and $\frac{3\pi}{2} < x < \frac{\pi}{2}$

B. $\frac{\pi}{2} < x < \frac{3\pi}{2}$

C. $\frac{\pi}{4} < x < \frac{3\pi}{4}$ and $\frac{5\pi}{4} < \frac{7\pi}{4}$

$\frac{5\pi}{4} < X < \frac{7\pi}{4}$

D. $0 < x < \frac{\pi}{4}$

10. Given the function $f(x) = x(x^2 - 8) - 5$ satisfies the hypothesis of the Mean Value Theorem on the interval $[1, 4]$, find a number C in the interval $(1, 4)$ which satisfies this theorem.

A. $\sqrt{5}$ B. $\sqrt{7}$ C. 7   D. 5

11. Given $f(x) = \sqrt[3]{x}$ on $[-1, 5]$. Why does f not satisfy the hypothesis of the Mean Value Theorem?

A. $f(0)$ does not exist

B. $f'(-1)$ does not exist

C. $f'(0)$ does not exist

D. f is not differentiable for $x < 0$

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

A. $y + 2 = 7(x - 7)$ B. $y + 2 = 9(x + 7)$

C. $y - 2 = 9(x - 7)$ D. $y + 7 = -9(x - 2)$

13. Approximate $f(5.011)$ if $f(5) = 9$ and $f'(5) = 9$.

A. ~~9.035~~   B. ~~8.978~~   C. ~~8.804~~   D. ~~9.023~~

A 9.035   B. 8.978

C 8.804   D 9.099

14. The position of an object is given by $s = t^2 - 3t + 8$. What is its average velocity for $2 \le t \le 4$?

A. 2   B. -2 C. 3   D. 0.333

15. If $f(x) = 3x(x + 2)^3$, find all point of inflection.

A. $(-1, 3)$ and $(-2, -27)$

B. $(1, 3)$ and $(2, 0)$

C. $(0, 0)$

D. $(-1, -3)$ and $(-2, 0)$

16. Find the x-coordiante(s) of the points of inflection on the curve $f(x) = \dfrac{2x}{x^2+3}$.

A. 0 only

B. ±3 only

C. 3, −3, 0

D. 0 and $\sqrt{3}$

17. Find a region where the graph of f is concave upward, if f is defined by $f(x) = (x^2 - 4)^3$ for all real numbers x.

A. $(-\infty, 2)$

B. $(\frac{4}{5}, 2)$

C. $(2, \infty)$

D. $(\frac{2}{\sqrt{3}}, 2)$

18. Find all intervals on which the following is concave upward: $f(x) = \dfrac{x+2}{x-5}$.

A. $(-\infty, \infty)$

B. $(-\infty, 5)$

C. $(5, \infty)$

D. $(5, -2)$

19. Given $f(x) = 8x^{1/3} + x^{4/3}$. For what values is the graph of f concave downwards?

A. $2 < x < 4$

B. $0 < x < 4$

C. $-\infty < x < 0$

D. $-\infty < x < 0$ and $0 < x < 4$

20. Let $f''(x) = 3x^2 - 4$ and let $f(x)$ have critical numbers −2, 0, and 2. Use the Second Derivative Test to determine which critical numbers, if any, gives a relative maximum.

A. 2   B. 0   C. ±2   D. 0, ±2

21. Given that $f'(x) = x \sin x$ for $0 < x < 4$, then f has a local maximum for $x \approx$

A. 2.029   B. 3.141   C. 4.000   D. 1.571

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

A. 0 only

B. 3 only

C. −3 and 3

D. −3, 0, 3

Deriv app review (MC)

23. Given that $f(x) = -x^2 + 8x - 15$ has a relative maximum at $x = 4$, choose the correct statement.

A. f' is negative for all real values

B. f' is positive on the interval $(4, \infty)$

C. f' is negative on the interval $(4, \infty)$

D. f' is negative on the interval $(-\infty, 4)$

24. For what x coordinate(s) does the function defined by $f(x) = 3x^5 - 5x^3 - 8$ have a relative *minimum*?

A. 0 and −1

B. 1 only

C. 1 and −1

D. −1 only

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

A. 1 min and −1 max

~~B. 1 min only~~

~~C. 2 min only~~

~~D. 2 max only~~

B ±1 min and 0 max
C 0 min and ±1 max
D 1 max and −1 min

26. What is the maximum area of a rectangle that can be inscribed in the curve $\dfrac{x^2}{9} + \dfrac{y^2}{4} = 1$?

A. $6\sqrt{2}$ B. 18   C. $18\sqrt{2}$ D. 12

27. What the exact values of the coordinates of the point on $y = 3x - 1$ that is closest to the point $(0, 0)$?

28. A scale model of a building is 8 inches wide and 27 inches tall. It is placed against a wall What is the length of the shortest pole that will reach the wall above it from the level ground?

A. $13\sqrt{3}$ in

B. $13\sqrt{13}$ in

C. 13 in

D. 21 in

29. An open box can be made from a square piece of material, by cutting equal squares from each corner and turning up the sides. Find the dimensions of the box of maximum volume if the material has dimension 6 cm by 6 cm.

A. 4 cm × 4 cm × 1 cm

B. 4.5 cm × 4.5 cm × 0.75 cm

C. 3.5 cm × 3.5 cm × 1.25 cm

D. 5 cm × 5 cm × 0.5 cm

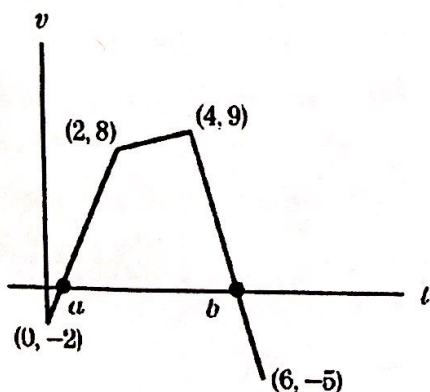30. The graph shows the velocity of an ladybug that is moving along a straight line for t on $[0, 6]$.

When is the speed of the object the least?

(2, 8) (4, 9)

$\leftarrow f'(x)$

a b

(0, −2)

(6, −5)
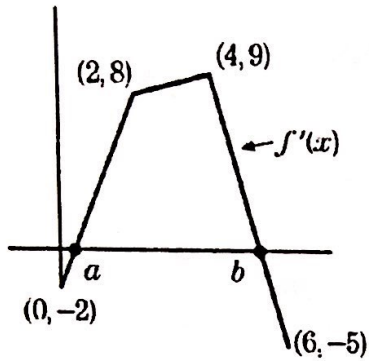
A. at $t = 0$
B. at $t = 6$
C. at $t = a$ and $t = b$
D. at $t = -5$

31. The graph shows the velocity of an object that is moving along a straight line for t on $[0, 6]$.

At what time(s) t does the object reverse direction?

v

(2, 8) (4, 9)

a b t

(0, −2)

(6, −5)

A. 2 and 4
B. a and b
C. 4 only
D. a only

32. The graph shows the velocity of a bumper car that is moving along a straight line for t on $[0, 6]$.

When is the acceleration of the object negative?

A. $(b, 6)$
B. $(0, 2)$ and $(2, 4)$
C. $(4, b)$
D. $(4, 6)$

33. The graph shows the velocity of mole that is moving along a straight tunnel for t on $[0, 6]$.

On the interval $4 < t < 6$, what is the acceleration of the object (in units/sec^2)?

A. 7
B. −7
C. −2
D. $\frac{1}{7}$

34. The position of a particle at any time t is given by $s = t^3 - \frac{9}{2}t^2 - 12t + 4$. What is the velocity after 5 seconds?

A. 21
B. 84
C. 18
D. −84

35. A sly fox starts at time $t = 0$ and moves along a path that can be related to 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 interval is the fox moving to the left?

A. $0 < t < 1$
B. $1 < t < 4$
C. $1 < t < 3$
D. $t > 3$

36. An amusement park patron is riding the Ferris wheel. Their height above the hub of the wheel at any given time is given by the formula $h(t) = 20 \sin 5t$ for $t \geq 0$. The vertical acceleration is

    A. $-100\pi \cos 5\pi t$ B. $-500\pi^3 \sin 5\pi t$

    C. $-500 \sin 5t$ D. $500 \sin 5t$

37. A particle moves along the curve given by $y = \sqrt{2x^3 - 7}$. Find the acceleration at 2 seconds.

    A. $-\frac{3}{4}$ units/sec^2 B. $-\frac{4}{3}$ units/sec^2

    C. $\frac{3}{4}$ units/sec^2 D. $\frac{4}{3}$ units/sec^2

38. A stone dropped in a still pond creates a circular ripple whose radius increases at a constant rate of 2 ft/s. At what rate is the area enclosed by the ripple increasing 10 s after the stone strikes the pond?

    A. 60π ft^2/s B. 200π ft^2/s

    C. 40π ft^2/s D. 80π ft^2/s

39. The radius of a sphere is increasing at a constant rate of 0.05 cm per second. At the time when the radius of the sphere is 10 cm, what is the rate of increase of the volume?

    Note: The volume of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.

    A. 2.5π cm^3/s B. 5π cm^3/s

    C. 15π cm^3/s D. 20π cm^3/s

40. An angler has hooked a fish. The fish is traveling in an east-west direction along a line 30 ft north of the angler. If the fishing line is leaving the reel at a rate of 6 ft/s when the fish is 50 ft from the angler, how fast is the fish traveling?

    A. $\frac{15}{2}$ ft/s B. $\frac{15}{4}$ ft/s

    C. $\frac{20}{3}$ ft/s D. $\frac{25}{3}$ ft/s

41. Two vehicles are approaching an intersection. One car from the east at 12 m/s and one van from the south at 16 m/s. How fast is the distance between the vehicles changing at the instant the truck is 30 m east and the van 40 m south of the intersection?

    A. $5\sqrt{2}$ m/s B. 17 m/s

    C. 20 m/s D. 25 m/s