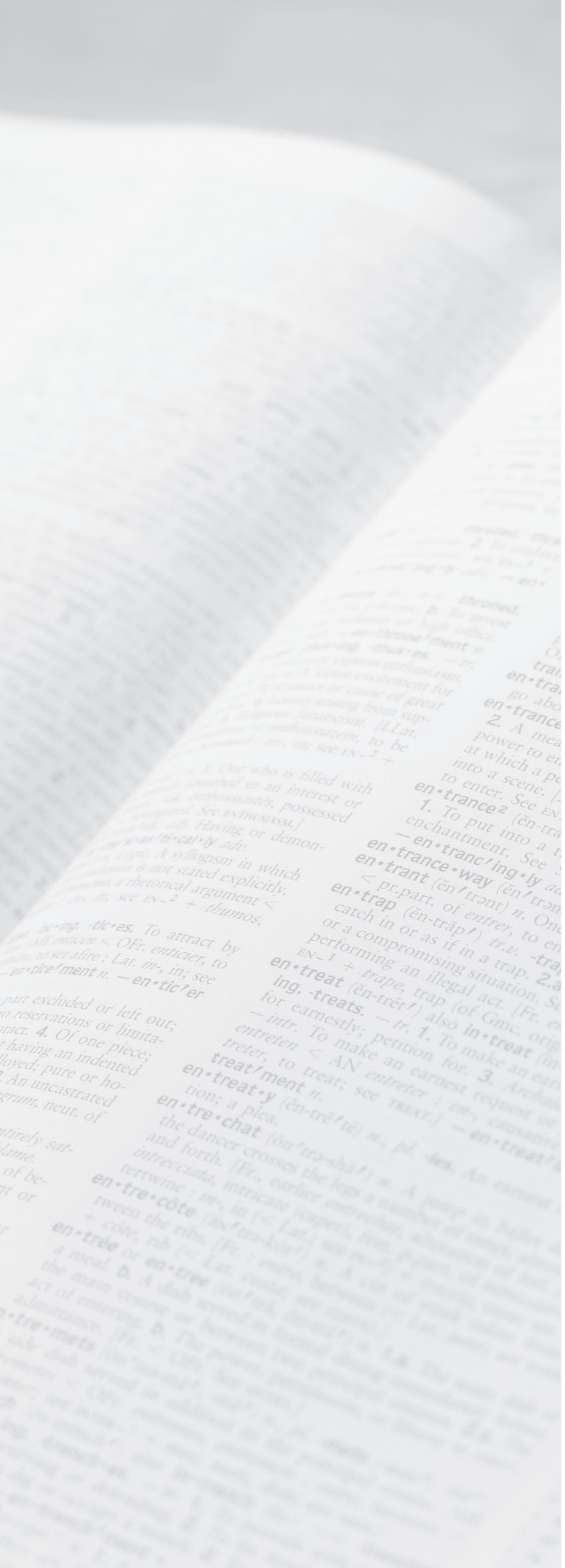

Chapter 13
Applications of Derivatives Drill 1

APPLICATIONS OF DERIVATIVES DRILL 1

1. Find the equation of the line tangent to $y = \frac{2x}{(x+1)}$ at (1,1).

   (A) $x - 2y = -1$
   (B) $2x - y = 1$
   (C) $x - y = 2$
   (D) $x - 2y = 1$
   (E) $2x + y = 1$

2. If $f(x) = \sqrt{4x+1}$, then find $f''(2)$.

   (A) -8
   (B) $-\frac{4}{27}$
   (C) 0
   (D) $\frac{4}{27}$
   (E) 8

3. Find the critical numbers of $y = 3x^4 + 4x^3 - 12x^2$.

   (A) 0
   (B) –2, 1
   (C) 0, 1
   (D) –2, 0, 1
   (E) –1, 0, 2

4. What is the maximum value of $f(x) = 2x^3 - 3x^2 - 12x + 1$ on the interval [–2,3]?

   (A) –3
   (B) 0
   (C) 2
   (D) 6
   (E) 8

5. Find the interval(s) on which f is decreasing for $f(x) = 2x^3 + 3x^2 - 36x$.

   (A) (–∞,–3)
   (B) (–2,3)
   (C) (–3,2)
   (D) (2,3)
   (E) (2,∞)

6. Find all critical numbers of $y = 2x^3 - 3x^2 - 12x$.

   (A) –2
   (B) –1
   (C) –2, –1
   (D) –1, 2
   (E) 1, 2

7. Find any points of inflection of $y = x^4 + 4x^3$.

   (A) (–2,–16)
   (B) (0,0)
   (C) (2,16) and (0,0)
   (D) (0,0) and (–2,–16)
   (E) (2,16)

8. Find the equation of the line tangent to $y = \sin(\sin x)$ at $(\pi, 0)$.

   (A) $x - y = \pi$
   (B) $x + y = \pi$
   (C) $2x - y = \pi$
   (D) $x - 2y = \pi$
   (E) $x + y = 2\pi$

9. Find the minimum value of $f(x) = 2x^3 + 3x^2 - 36x$.

   (A) –44
   (B) –9
   (C) 3
   (D) 9
   (E) 44

10. What is the point of inflection of $f(x) = (x + 1)^5 - 5x - 2$?

(A) (–3,1)
(B) (–1,3)
(C) (0,0)
(D) (1,3)
(E) (3,1)

11. On what interval(s) is f decreasing if $f(x) = 2 + 2x^2 - x^4$?

(A) (–1,0) only
(B) (1,∞) only
(C) (–∞,–1) and (0,1)
(D) (–1,0) and (1,∞)
(E) (0,1) only

12. A particle is traveling according to $f(x) = x^3 - 12x^2 + 36x$. What is the velocity at $x = 3$ seconds?

(A) –18
(B) –9
(C) 0
(D) 9
(E) 18

13. If a ball is thrown upward with a velocity of 80 ft/s, then its height after t seconds is $s = 80t - 16t^2$. What is the maximum height of the ball?

(A) 2.5
(B) 80
(C) 100
(D) 180
(E) 270

14. Find the equation of the normal line to the curve $y = \dfrac{\sqrt{x}}{(1 + x^2)}$ at $\left(1, \dfrac{1}{2}\right)$.

(A) $8x + 2y = 7$
(B) $2x + 8y = 7$
(C) $8x - 2y = 7$
(D) $2x - 8y = 7$
(E) $8x - 2y = -7$

15. For what values of x does the graph of $f(x) = x + 2\sin x$ have a horizontal tangent on $[0,2\pi]$?

(A) $\dfrac{\pi}{3}$ and $\dfrac{2\pi}{3}$

(B) $\dfrac{2\pi}{3}$ and $\dfrac{4\pi}{3}$

(C) $\dfrac{4\pi}{3}$ and $\dfrac{5\pi}{3}$

(D) $\dfrac{4\pi}{3}$ only

(E) no values

16. Find an equation of the tangent line to the curve $y = 2x \sin x$ at the point $\left(\dfrac{\pi}{2}, \pi\right)$.

(A) $y = 2x + \pi$

(B) $y = 2x - \pi$

(C) $y = 2x$

(D) $y = 2x + \left(\dfrac{\pi}{2}\right)$

(E) $y = 2x - \left(\dfrac{\pi}{2}\right)$

17. A particle travels in a position governed by the equation $s(t) = 4t^3 - 16t^2$. What is its acceleration at $t = 2$ seconds?

(A) 0
(B) 2
(C) 10
(D) 12
(E) 16

18. If a particle travels along a path according to the equation $s(t) = 6t^2 - 4t + 3$, then what is the velocity at $t = 2$ seconds?

(A) –20
(B) –10
(C) 0
(D) 10
(E) 20

19. Find the absolute maximum value of $f(x) = (x^2 + 2x)^3$ on the interval [–2,1].

(A) – 2
(B) – 1
(C) 0
(D) 1
(E) 27

20. What is the x-coordinate of the point of inflection of $f(x) = 4x^3 + 3x^2 - 6x$?

(A) –4
(B) $-\frac{1}{4}$
(C) 0
(D) $\frac{1}{4}$
(E) 4

21. On what interval(s) is f decreasing for $f(x) = \frac{x^2}{(x^2 + 3)}$?

(A) $(-\infty,\infty)$
(B) $(-\infty,0)$
(C) $(0,\infty)$
(D) $(-\infty,-3)$
(E) $(-3,\infty)$

Questions 22–23 rely on the following information:

Suppose that $h(x) = f(x)\ g(x)$ and $F(x) = f(g(x))$, where $f(2) = 3$, $g(2) = 5$, $g'(2) = 4$, $f'(2) = -2$, and $f'(5) = 11$.

22. What is the value of $F'(2)$?

(A) 44
(B) 22
(C) 2
(D) –22
(E) –44

23. What is the value of $h'(2)$?

(A) 10
(B) 5
(C) 2
(D) –5
(E) –10

24. A particle moves on a vertical line so that its coordinate at time t is given by $y = t^3 - 12t + 3$, where $t \geq 0$. What is its acceleration at time t ?

(A) $\frac{1}{4}t^4 - 6t^2 + 3t + 1$
(B) $3t^2 - 12$
(C) 6t
(D) 6
(E) 0

25. Find the equation of the tangent line to the equation $x^2 + xy + y^2 = 3$ at the point (1,1).

(A) $x - y = -2$
(B) $x + y = -2$
(C) $2x + y = 2$
(D) $x - y = 2$
(E) $x + y = 2$

26. Find the equation of the tangent line to the equation $x^2 + 2xy - y^2 + x = 2$ at (1,2).

(A) $x - 3y = 1$
(B) $7x + 2y = 3$
(C) $7x - 2y = 3$
(D) $3x + y = 1$
(E) $3x - y = 3$

27. What is the slope of the equation $\sin(xy) = 0$ at $\left(2, \frac{\pi}{2}\right)$?

(A) $-\pi$
(B) $-\frac{\pi}{2}$
(C) $-\frac{\pi}{4}$
(D) $-\frac{\pi}{6}$
(E) $\frac{\pi}{4}$