

Applications of the Derivative - Part II

1. $c = 2$
2. $c = \frac{2}{3}$
3. Rolle's Thm does not apply
4. $c = \frac{\pi}{2}$ or $c = \frac{3\pi}{2}$
5. $c = \frac{\pi}{2}$
6. $c = -\frac{1}{3}$
7. MVT does not apply
8. $c = 1$
9. $c \approx 0.217$ or $c \approx 1.748$
10. No, f is not continuous on $[-5, -1]$ or differentiable on $(-5, -1)$
11. No. f is not differentiable on $(-2, 8)$
12. Yes. f is continuous on $[-1, 8]$ and differentiable on $(-1, 8)$
13. No, f is differentiable on $(0, 5)$
14. $c \approx 0.093, 1.478, 3.234, 4.620$
15. -6.015
16. (a) $B'(7) \approx 1.530$, which means the number of beds in use is increasing at a rate of 1.53 beds per day on the 7th day. (b) The maximum number of beds in use is 70.
17. 4
18. $(0, 2)$
19. $(2, 6)$
20. $(2, 3)$
21. (a) $p'(2) = 2e^4 - 5 \approx 104.196$; $p''(2) = 4e^4 \approx 218.393$
(b) It is speeding up
(c) left: $(0, 0.458)$; right: $(0.458, \infty)$
(d) yes, at $t = 0.458$
22. (a) 1.911
(b) $e^{2-t}(5 - 2t)$
(c) $\frac{5}{2}$
23. moving left on $(0, 2)$ since $v < 0$, momentarily at rest at $t = 2$ since $v = 0$, moving right on $(2, \infty)$ since $v > 0$.
Slowing down on $(0, 2)$ since $a > 0$ and $v < 0$, speeding up on $(2, \infty)$ since $a > 0$ and $v > 0$
24. (a) $-\frac{47}{150}$ miles per minute squared
(b) $(25, 30)$
(c) away from
(d) -2.015 miles per minute squared; velocity is decreasing

25. speeding up
26. (a) left: $(1, 5.2)$; right: $[0, 1) \cup (5.2, 7)$
 (b) slowing down: $(0, 1) \cup (3, 5.2) \cup (6, 7)$; speeding up: $(1, 2) \cup (5.2, 6)$
 (c) $t = 1$ and $t = 5.2$
 (d) $(2, 3) \cup (7, 9)$
27. (a) -8 ft/sec
 (b) $(0, 3)$
 (c) $p'(3) = 0$, $p''(3) = 10$ At $t = 3$ seconds, the particle is momentarily at rest and changing direction (begins moving to the right).
 (d) 0
 (e) 40 feet
28. 2.555
29. (a) $(0, 1)$ only
 (b) $(2, 3) \cup (5, 6)$
 (c) $v(t) = \begin{cases} 2, & 0 < t < 1 \\ 0, & 1 < t < 2 \\ -\frac{1}{4}, & 2 < t < 3 \\ 0, & 3 < t < 5 \\ -2, & 5 < t < 6 \end{cases}$
 (d) $t = 1, 2, 3, 5$
 (e) $-\frac{6}{5}$ cm/sec
30. (a) 3
 (b) 0; the particle is at rest
 (c) 0.845 m/sec²
31. (a) -35 ft/min²
 (b) $(2, 3)$
 (c) No
 (d) 4 minutes
32. (a) 1.588; speed is decreasing at $t = 2$
 (b) 2.507
33. (a) $(0, 35) \cup (45, 50)$
 (b) 1.44 ft/sec²
 (c) 2.1 ft/sec²
 (d) speed is decreasing
34. (a) 6.667 m/sec; 6.857 m/sec
 (b) 3.333 m/sec²; 1.469 m/sec²
35. (a) $-\frac{\pi}{6}$
 (b) Statement I true; Statement II false
36. $(\frac{5}{2}, \sqrt{\frac{11}{2}})$

37. $\frac{100}{3}$ by 25 feet

38. 8 by 8 feet

39. $\sqrt{\frac{25}{2}}$ by $\sqrt{\frac{25}{2}}$

40. 4.48 by 2.24 feet

41. 90.741 cubic inches

42. $r = 2$