

The following answers are not guaranteed. If in doubt check with your instructor or TA.

1. (a) $7x^6 - 12x^2$

(b) $(3x^2) \sin 2x + (x^3 + 1)(2 \cos 2x)$

(c) $\frac{2(3x^2 + 5) - (2x - 1)(6x)}{(3x^2 + 5)^2} \cdot 2\sqrt{\frac{2x - 1}{3x^2 + 5}}$

(d) $\sec^2(3x^2 - x + 1)(6x - 1)$

(e) $\sqrt{\sin^3 x + 1} \cos x$

2.

(a) 4

(b) $\frac{5}{3}\sqrt{5} - \sqrt{3}$

(c) $\frac{2}{5}x^{5/2} + \frac{2}{3}x^{3/2} - 2\sqrt{x} + C.$

(d) $\frac{1}{4(1 + \cos x)^4} + C$

3. $\frac{32}{27}$

4.

(a) $y = 2x - 6$

(b) Horizontal: $(\sqrt{3}, 2\sqrt{3}), (-\sqrt{3}, -2\sqrt{3})$; vertical: $(2\sqrt{3}, \sqrt{3}), (-2\sqrt{3}, -\sqrt{3})$

5. $\frac{8}{3}$ feet per second

6.

(a) Vertical: $x = -2, x = 2$; horizontal: $y = 1$.

(b) Increasing: $(0, 2), (2, \infty)$; decreasing: $(-\infty, -2), (-2, 0)$.

(c) Concave up: $(-2, 2)$; concave down: $(-\infty, -2), (2, \infty)$.

(d) None. The concavity changes at $x = -2, x = 2$, but the function is undefined at these points.

(e) $(0, 9/4)$ is a local minimum and the only critical point.

To check if your graph is correct, use Maple.

7. Width of base = 2 feet, height = 1 foot. Justification: the function is $10x^2 + \frac{40}{x}$ defined for $x > 0$. It has precisely one critical point in this interval: at $x = 2$. The second derivative at $x = 2$ is positive so the point is a local minimum. But if this is not an absolute minimum, the function would have to have other critical points where it 'turned around'. (The function is everywhere differentiable.) There are many other possible ways of justifying the conclusion. However, just saying the second derivative is positive would not suffice because the critical point could in principle be just a local minimum.

8. 484 feet

9. $x_1 = -1, x_2 = 1, x_3 = -1, x_4 = 1$, etc. So the sequence oscillates between 1 and -1 and never approaches a limit.