



3.8 Slopes of Tangents

1. (a) $x + y = 0$
(b) $6x + y - 8 = 0$
(c) $4x - y - 2 = 0$
2. $6x - y - 9 = 0$
3. $10x - y + 2 = 0$
4. $(1, 6)$
5. $(2, -18)$ and $(-1, 12)$
6. $(-2, -16)$ and $(4, 2)$
7. $a = 3$ and $b = 5$
8. $p = 2$ and $q = -3$
9. $a = 3$ and $b = 2$
10. (a) $a = 1, b = 0, c = -7, d = -6$
(b) $x = -2, x = -1, x = 3$
11. (a) $a = 1, b = 2, c = -11, d = -12$
(b) Fill in -4 for x
(c) $x = -1, x = 3$

3.9 Turning Points

1. $(2, -1)$ min
2. (a) $(1, 2)$ max $(2, 1)$ min
(b) $(0, 0)$ min $(-1, \frac{1}{e^2})$ max
(c) $(0, 0)$ min $(-6, -36)$ max
3. $(2, 20)$ min $(-2, -20)$ max
4. (a) -16
(b) $(\frac{1}{3}, -3.2)$ max
5. $(-1, -0.39)$ max
6. $(0, 25)$ max $(5, 0)$ min
7. $(\frac{1}{k}, -\frac{1}{ke})$ min
8. $(\frac{\pi}{12}, 0.32)$ max
9. $a = 1, b = 6, c = -36, d = 40$





10. (a) $(0.5, 23.5)$
(b) $(3, 33)$
11. $a = 1, b = 3, c = -24, d = 20$
12. $a = 2, b = 3$
13. (a) $(0, 32)$ and $(4k, -32k^3 + 32)$
(b) $k < 1$

3.10 Related Rates of Change

1. $\frac{dA}{dt} = 60\pi \text{ cm}^2/\text{s}$
2. $\frac{dr}{dt} = 4 \text{ cm/s}$
3. $\frac{dA}{dt} = 60 \text{ cm}^2/\text{s}$
4. $\frac{dx}{dt} = 10 \text{ cm/s}$
5. i. $\frac{dV}{dt} = 384\pi \text{ cm}^3/\text{s}$
ii. $\frac{dA}{dt} = 240\pi \text{ cm}^2/\text{s}$
6. i. $\frac{dr}{dt} = \frac{12}{r^2} \text{ cm/s}$
ii. $\frac{dr}{dt} = \frac{4}{3} \text{ cm/s}$
iii. $\frac{dA}{dt} = 24\pi \text{ cm}^2/\text{s}$
7. i. $V = 2\pi r^3$
ii. $\frac{dV}{dt} = 1.5 \text{ m}^3/\text{s}$
8. $\frac{dA}{dt} = 40\pi \text{ cm}^2/\text{s}$
9. (a) $V = \frac{\pi h^3}{75}$
(b) $\frac{dh}{dt} = 4.762\pi \text{ cm/s}$

3.11 Exam Questions

1. i. Proof
ii. $f^{-1}(x) = \frac{x+2}{3}$
2. (a) Proof
(b) i. $\frac{dy}{dx} = \sin\left(\frac{1}{x}\right) - \frac{1}{x} \cos\left(\frac{1}{x}\right)$
ii. Slope = 0.15
3. i. $\frac{5}{32\pi} \text{ cm/sec}$
ii. $25 \text{ cm}^2/\text{sec}$
4. (a) i. 4.529





- ii. 52°
 iii. Proof
 iv. $g(x) = -0.274x^2 + 1.467x + 2$
- (b) i. 200m: 1000 points, Javelin: 1020 points
 ii. 72.23 m
 iii. $c = 1.88$
5. (a) $x = 3$
 (b) $\frac{dy}{dx} = 1 - \frac{1}{2\sqrt{x+6}}$
 (c) $(-5.75, -6.25)$
6. (a) i. Use $f(0) = 0$ to show $d = 0$.
 ii. Use $f(-5) = 0.15$ to show $c = 0$.
 (b) i. $f'(-4) = -0.0288$
 ii. 2°
 (c) $f''(-2.5) = 0$ and $f(-2.5) = 0.075$
 (d) i. .
 ii. (x, y)
7. (a) i.

Time (minutes)	1	2	3	4	5	6
Volume (10^6cm^3)	4	8	12	16	20	24

 ii. .
 iii. $V(t) = (4 \times 10^6)t \text{ cm}^3$
 (b) i. $V = 0.1\pi r^2 \text{ cm}^3$
 ii. $\frac{4000}{\pi} = 1273 \text{ cm/min}$
 (c) .
 (d) 13 hours
8. (a) 16 hours and 50 minutes
 (b) 36 days after March 21st which is April 26th
 (c) $f'(t) = \frac{9.5\pi}{365} \cos\left(\frac{2\pi}{365}t\right)$
 (d) 17 hours
 (e) 15 hours and 15 minutes
9. (a) $C(24, 7.488)$
 (b) $D(10, 5), E(38, 5)$
 (c) $194m^2$
 (d) $y - 7.488 = -0.013(x - 24)^2$
 (e) $y = -2x^2 + 12x - 22$
10. (a) $4x - 3$





- (b) $(-6, 3), (2, 1)$
11. (a) .
(b) i. $(-3, 0), (0, -6), (1, -8)$
12. .
13. (a) .
(b) $\frac{k \pm \sqrt{k^2 - 4}}{2}$
(c) $-2 < k < 2$
14. (a) Maximum value: 20, Minimum value: -4
(b) f is **not** injective. Each element in the domain does not map on to a unique element in the range.
15. (a) 100 cm
(b) 400 sec
(c) $680 \text{ cm}^3/\text{s}$
(d) 216.32 cm/s
(e) .
(f) 0.6

