Mid-Chapter Review

1. Calculate the product of each radical expression and its corresponding conjugate.
   a. $\sqrt{5} - \sqrt{2}$ b. $3\sqrt{5} + 2\sqrt{2}$ c. $9 + 2\sqrt{5}$ d. $3\sqrt{5} - 2\sqrt{10}$
2. Rationalize each denominator.
   a. $\dfrac{6 + \sqrt{2}}{\sqrt{3}}$ c. $\dfrac{5}{\sqrt{7} - 4}$ e. $\dfrac{5\sqrt{3}}{2\sqrt{3} + 4}$
   b. $\dfrac{2\sqrt{3} + 4}{\sqrt{3}}$ d. $\dfrac{2\sqrt{3}}{\sqrt{3} - 2}$ f. $\dfrac{3\sqrt{2}}{2\sqrt{3} - 5}$
3. Rationalize each numerator.
   a. $\dfrac{\sqrt{2}}{5}$ c. $\dfrac{\sqrt{7} - 4}{5}$ e. $\dfrac{\sqrt{3} - \sqrt{7}}{4}$
   b. $\dfrac{\sqrt{3}}{6 + \sqrt{2}}$ d. $\dfrac{2\sqrt{3} - 5}{3\sqrt{2}}$ f. $\dfrac{2\sqrt{3} + \sqrt{7}}{5}$
4. Determine the equation of the line described by the given information.
   a. slope $-\frac{2}{3}$, passing through point $(0, 6)$
   b. passing through points $(2, 7)$ and $(6, 11)$
   c. parallel to $y = 4x - 6$, passing through point $(2, 6)$
   d. perpendicular to $y = -5x + 3$, passing through point $(-1, -2)$
5. Find the slope of PQ, in simplified form, given $P(1, -1)$ and $Q(1 + h, f(1 + h))$, where $f(x) = -x^2$.
6. Consider the function $y = x^2 - 2x - 2$.
   a. Copy and complete the following tables of values. P and Q are points on the graph of $f(x)$.

P	**Q**	**Slope of Line PQ**
$(-1, 1)$	$(-2, 6)$	$\frac{-5}{1} = -5$
$(-1, 1)$	$(-1.5, 3.25)$	
$(-1, 1)$	$(-1.1, \quad)$	
$(-1, 1)$	$(-1.01, \quad)$	
$(-1, 1)$	$(-1.001, \quad)$	

P	**Q**	**Slope of Line PQ**
$(-1, 1)$	$(0, \quad)$	
$(-1, 1)$	$(-0.5, \quad)$	
$(-1, 1)$	$(-0.9, \quad)$	
$(-1, 1)$	$(-0.99, \quad)$	
$(-1, 1)$	$(-0.999, \quad)$	

b. Use your results for part a to approximate the slope of the tangent to the graph of $f(x)$ at point P.

c. Calculate the slope of the secant where the x-coordinate of Q is $-1 + h$.

d. Use your results for part c to calculate the slope of the tangent to the graph of $f(x)$ at point P.

e. Compare your answers for parts b and d.

7. Calculate the slope of the tangent to each curve at the given point or value of x.

a. $f(x) = x^2 + 3x - 5, (-3,-5)$

b. $y = \frac{1}{x}, x = \frac{1}{3}$

c. $y = \frac{4}{x - 2}, (6, 1)$

d. $f(x) = \sqrt{x + 4}, x = 5$

8. The function $s(t) = 6t(t + 1)$ describes the distance (in kilometres) that a car has travelled after a time t (in hours), for $0 \leq t \leq 6$.

a. Calculate the average velocity of the car during the following intervals.

i. from $t = 2$ to $t = 3$
ii. from $t = 2$ to $t = 2.1$
iii. from $t = 2$ to $t = 2.01$

b. Use your results for part a to approximate the instantaneous velocity of the car when $t = 2$.

c. Find the average velocity of the car from $t = 2$ to $t = 2 + h$.

d. Use your results for part c to find the velocity when $t = 2$.

9. Calculate the instantaneous rate of change of $f(x)$ with respect to x at the given value of x.

a. $f(x) = 5 - x^2, x = 2$

b. $f(x) = \frac{3}{x}, x = \frac{1}{2}$

10. An oil tank is being drained for cleaning. After t minutes, there are V litres of oil left in the tank, where $V(t) = 50(30 - t)^2, 0 \leq t \leq 30$.

a. Calculate the average rate of change in volume during the first 20 min.

b. Calculate the rate of change in volume at time $t = 20$.

11. Find the equation of the tangent at the given value of x.

a. $y = x^2 + x - 3, x = 4$

b. $y = 2x^2 - 7, x = -2$

c. $f(x) = 3x^2 + 2x - 5, x = -1$

d. $f(x) = 5x^2 - 8x + 3, x = 1$

12. Find the equation of the tangent to the graph of the function at the given value of x.

a. $f(x) = \frac{x}{x + 3}, x = -5$

b. $f(x) = \frac{2x + 5}{5x - 1}, x = -1$