Section 3.2

Exercise 1. Find the derivatives

1. $f_1(x) = 3$ at a where a is a real number.

2. $f_2(x) = x^3$ at a where a is a real number.

3. $f_3(x) = \sqrt{x}$ at a where a is a real number.

4. $g(x) = 5x^3$ at a where a is a real number. Check that $g'(x) = 5f_2'(x)$.

Theorem: Let f and g be 2 functions, k and n be 2 real numbers with $n \neq 0$.

Function	*Derivative*	*Example*
Constant	0	$(3)' = 0$
x^n	nx^{n-1}	$\left(x^3\right)' = 3x^2$
kf	$kf'(x)$	$(5x^3)' = 5\,(3x^2)$
$f+g$	$f'+g'$	$\left(x^3+x^2\right)' = 3x^2+2x$
$f-g$	$f'-g'$	$(x^3-x^2)' = 3x^2-2x$
fg	$f'g+g'f$	$((x^2-1)(x^3))' =$ $(2x)(x^3)+(x^2-1)(3x^2)$
$\dfrac{f}{g}$	$\dfrac{f'g-g'f}{g^2}$	$\left(\dfrac{x^2-x}{x^3+1}\right)' =$ $\dfrac{(2x-1)(x^3+1)-(3x^2)(x^2-x)}{(x^3+1)^2}$

Exercise 2. Using the derivative rules, find the derivatives of the following functions:

1. $f(x) = x^5 - x^2 + 3x + 7.$

2. $f(x) = \dfrac{1}{x^2} + 5\sqrt{x} - 7x^{-3} + \dfrac{3}{x} + \sqrt[3]{x^2}.$

3. $f(x) = \sqrt{x}(x^2 - 5x + 3).$

4. $f(x) = (x^2 + 4)(x + \dfrac{1}{x}).$

5. $f(x) = \dfrac{3x + 4}{5x - 7}.$

6. $f(x) = \dfrac{\sqrt{x} + 5}{x^2 + 3x - 1}.$

Exercise 3. Find a Cartesian equation of the tangent line to the curve $y = \dfrac{x}{x-1}$ at the point $(3, 3/2)$.

Exercise 4. (44p168) Find the equations of the tangent line to the curve $y = \dfrac{x-1}{x+1}$ that is parallel to the line $x - 2y = 1$.

Exercise 5. For values of x does the graph of $f(x) = x^3 - 3x^2 - 9x + 18$ has horizontal tangent?

Exercise 6. (69p169)

1. For what values of x is the function $f(x) = |x^2 - 9|$ differentiable? Find a formula for f'.

2. Sketch the graph of f and f'.

Exercise 7. (53p169) Given the curve $y = \sqrt[3]{x}$.

Find an equation to the normal line to the curve at the point $(-8, -2)$. (The normal line to a curve C at a point P is the line that passes through P and that is orthogonal to the tangent line to C at P)