Section 2.2

Derivatives and the slope of a tangent line

Review of the Power Rule

$Given\ \ f(x)=ax^n,\ \ f'(x)=nax^{n-1}$

Example 1

$Given\ \ f(x)=x^3+5x,\ \ find\ \ f'(x)$

$f'(x)=3x^{3-1}+5$

$f'(x)=3x^2+5$

Example 2

$Given\ \ f(x)=2x^3-4x^2-5x,\ \ find\ \ f'(x)$

$f'(x)=3\cdot 2x^{3-1}-4\cdot 2x^{2-1}-5\cdot 1x^{1-1}$

$f'(x)=6x^2-8x-5x^0$

$f'(x)=6x^2-8x-5$

Example 3

$Given\ \ f(x)=\dfrac{1}{x^4},\ \ find\ \ f'(x)$

$f(x)=x^{-4}$

$f'(x)=-4x^{-4-1}=-4x^{-5}=\dfrac{-4}{x^5}$

Example 4

$Given\ f(x)=\dfrac{3}{x^3}+\dfrac{2}{x^4},\ \ find\ \ f'(x)$

$f(x)=3x^{-3}+2x^{-4}$

$f(x)=-3\cdot 3x^{-3-1}-4\cdot 2x^{-4-1}=-9x^{-4}-8x^{-5}=-\dfrac{9}{x^4}-\dfrac{8}{x^5}$

Example 5

$$f(x) = \sqrt{x}, \ \ find \ \ f'(x)$$
$$f(x) = x^{\frac{1}{2}}$$
$$f'(x) = \frac{1}{2}x^{\frac{1}{2}-1} = \frac{1}{2}x^{-\frac{1}{2}} = \frac{1}{2x^{\frac{1}{2}}} = \frac{1}{2\sqrt{x}}$$

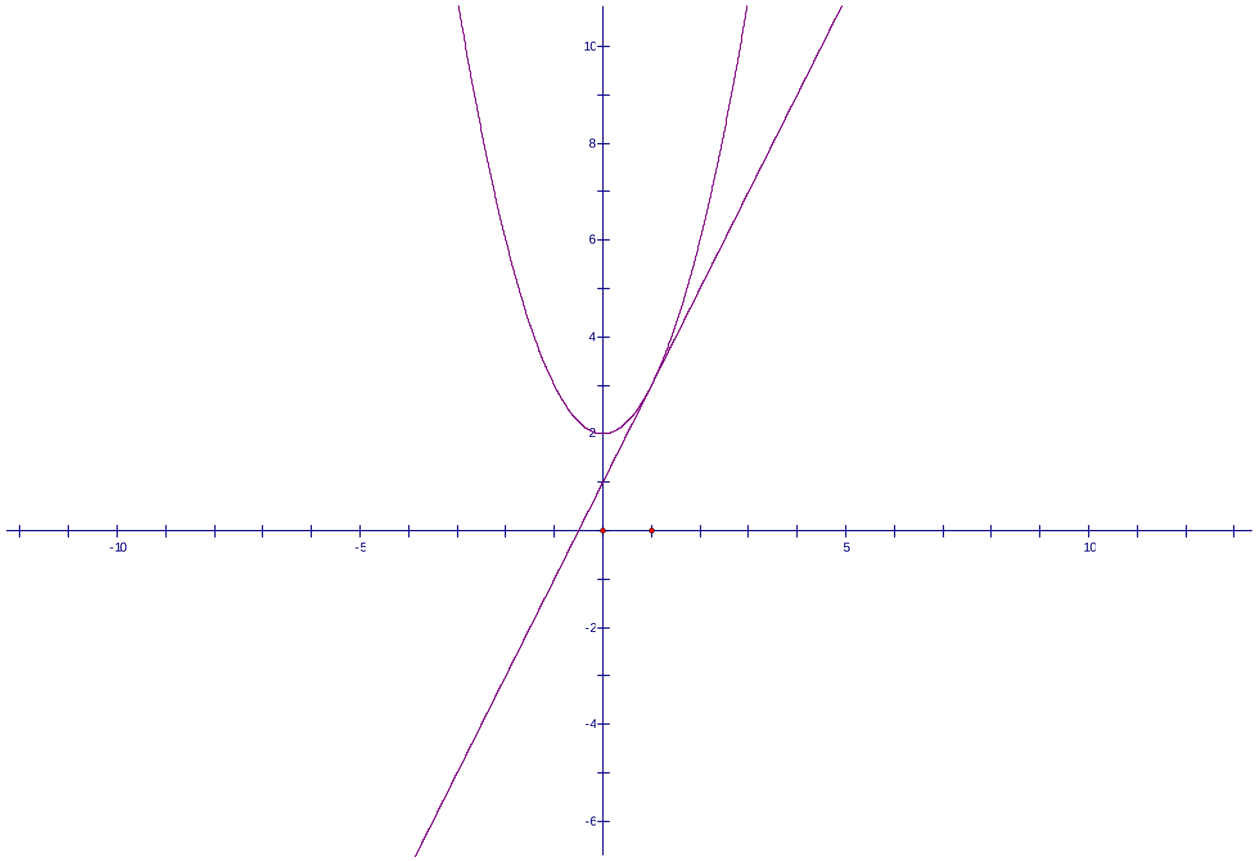
Example 6

$$f(x) = 7\sqrt{x}, \ \ find \ \ f'(x)$$
$$f(x) = 7x^{\frac{1}{2}}$$
$$f'(x) = \frac{7}{2}x^{\frac{1}{2}-1} = \frac{7}{2}x^{-\frac{1}{2}} = \frac{7}{2x^{\frac{1}{2}}} = \frac{7}{2\sqrt{x}}$$

Example 7

Find the slope of the tangent line to the function $f(x) = x^2 + 2$ at the point (1,3)

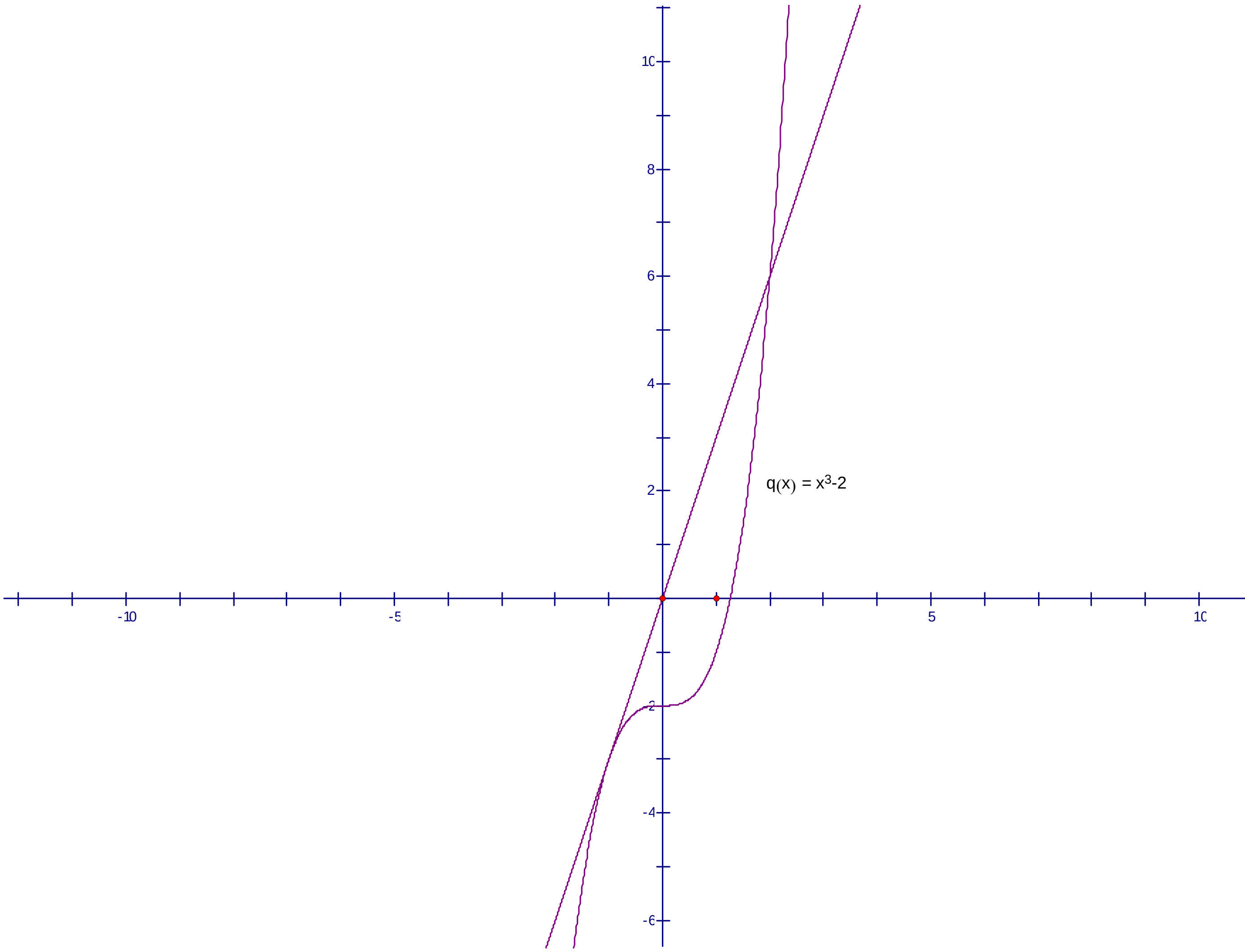
$$f'(x) = 2x^{2-1} = 2x$$
$$m = f'(1) = 2(1) = 2$$



Example 8

Find the slope of the tangent line to the function $f(x) = x^3 + 2$ at the point (-1,1)

$$f(x) = x^3 + 2$$
$$f'(x) = 3x^{3-2} = 3x^2$$
$$m = f'(-1) = 3(-1)^2 = 3(1) = 3$$



q(x) = x3-2
10
8
6
4
2
-2
-4
-6
-10
-5
5
10

Example 9

Find the equation of the tangent line to the function $f(x) = x^2 - x$ that passes through the point (2,2)

$$f(x) = x^2 - x$$
$$f'(x) = 2x^{2-1} - 1x^{1-1} = 2x - 1$$

$$m = f'(2) = 2(2) - 1 = 4 - 1 = 3$$
$$y - y_1 = m(x - x_1)$$
$$y - 2 = 3(x - 2)$$
$$y - 2 = 3x - 6$$
$$y - 2 + 2 = 3x - 6 + 2$$
$$y = 3x - 4$$

Graph of Example 9