

## C1 Lesson 3 - Tangent & Normal Lines

### Using Rate of Change

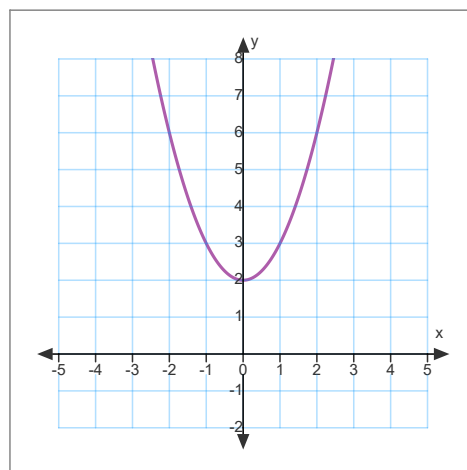
- secant lines
- tangent lines
- normal lines

### Secant Lines

The slope of a secant line is the average rate of change of a function between two points.

**EXAMPLE 1:** Consider the graph of  $y = x^2 + 2$

Find the slope and equation of the secant line through the points where  $x = -1$  and  $x = 2$ . Then draw  $f(x)$  with this secant line.



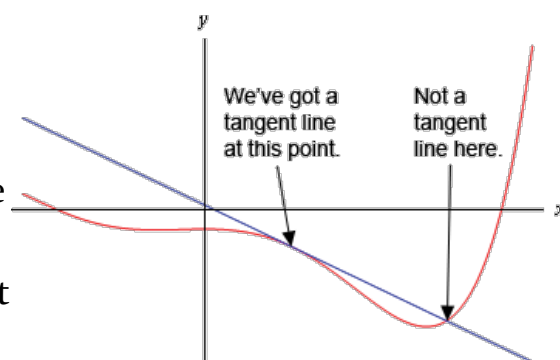
## C1 Lesson 3 - Tangent & Normal Lines

### Tangent Lines

The slope of the tangent line at a point is also called the **slope of the curve** at the point and corresponds to the instantaneous rate of change of  $y$  with respect to  $x$  at the point.

But what is a tangent line?

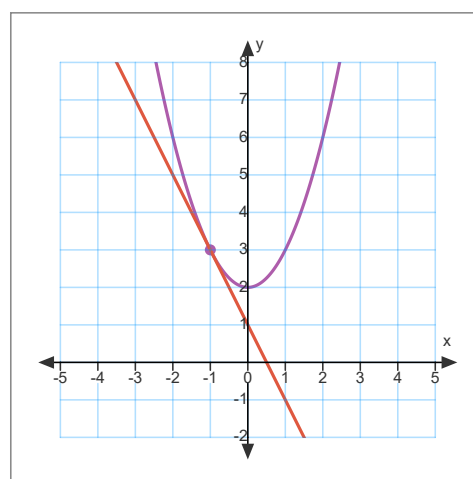
A tangent line to the function  $f(x)$  at the point  $x = a$  is a line that just touches the graph of the function at the point in question and is "parallel" to the graph at that point.



In this graph the line is tangent at the indicated point, but not tangent at the second point (where it crosses through).

**EXAMPLE 2:** Consider the graph of  $y = x^2 + 2$

Find the slope and equation of tangent line at  $x = -1$ . Then sketch the graph of both on the same axes.



$$y = -2x + 1$$

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### EXAMPLE 3:

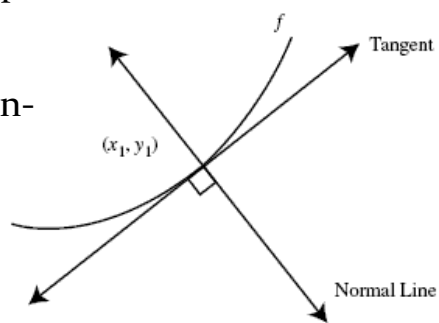
Find the equation of the line tangent to  $y = \frac{2}{x-3}$  at  $x = 1$ .

### Normal Lines

There are many applications in physics that depend on a line that is normal (perpendicular) to a surface.

A line that is normal to a curve at  $x = a$  is perpendicular to the line tangent to the curve at  $x = a$ .

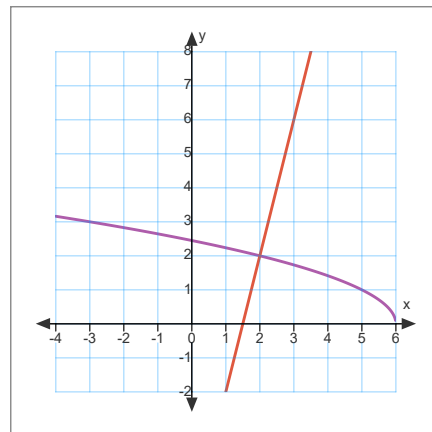
Recall that the slopes of lines that are perpendicular are negative reciprocals of each other.



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### EXAMPLE 4:

Find the equation of the line normal to the curve  $y = \sqrt{6-x}$  at  $x = 2$ .



$$y = 4x - 6$$

Practice Questions:

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