

# Calculus BC

## Section 3.8 - Newton's Method

Obj: - To approximate a zero of a function using Newton's method.

Newton's method – a numerical iteration technique to solve  $f(x) = 0$

Method:

- 1) Guess a first approximation to a root of  $f(x) = 0$ .  
Graph may be useful.
- 2) Use 1<sup>st</sup> approximation  $x_1$  to get a second,  $x_2$   
Use 2<sup>nd</sup> approximation  $x_2$  to get a third,  $x_3$   
Use 3<sup>rd</sup> approximation  $x_3$  to get a fourth,  $x_4$

.....

where

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

1. Solve  $f(x) = x^3 - x - 1 = 0$

$$f'(x) =$$

(look at graph for first estimate-optional)

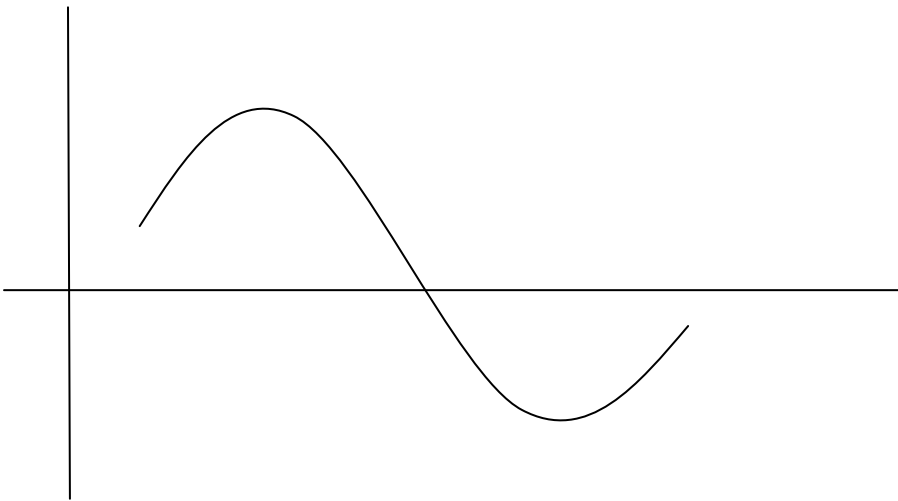
guess  $x_1$ :

$$x_2 =$$

$$x_3 =$$

$$x_4 =$$

Deriving the formula for Newton's method

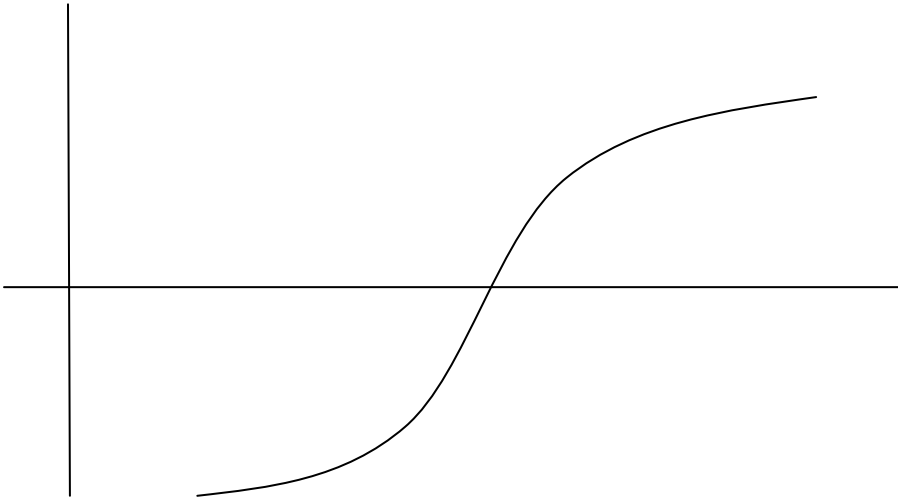


First guess  $x_1$

Tangent line through point  $(x_1, y_1)$

x-intercept of tangent line (will become new approximation)

When will the formula  $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$  not work?



2. Solve  $\sin x = \cos^2 x$

$$f(x) = \sin x - \cos^2 x = 0$$

$$f'(x) = \cos x + 2\cos x \sin x$$