STRAND 4   **GRAPHS**
4.1   GRAPHS

Learning Objective

At the end of this lesson, students should be able to:
 • Draw cubic graphs

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Graphing Cubic Functions

1) A cubic function has the form

$$f(x) = ax^3 + bx^2 + cx + d \;\rightarrow\; \textbf{Expanded form}$$

$$f(x) = (x - a)(x - b)(c - c) \;\rightarrow\; \textbf{Factored form}$$

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2) A cubic function has the degree 3 (i.e. the highest power of the variable is 3).
3) When a cubic function in expanded form is factorized, it can have a maximum of 3

   factors. For a factor $(x - a)^n$, if n is odd then there is an inflection at x = a and if n is

   even there is a turning point at x = a.
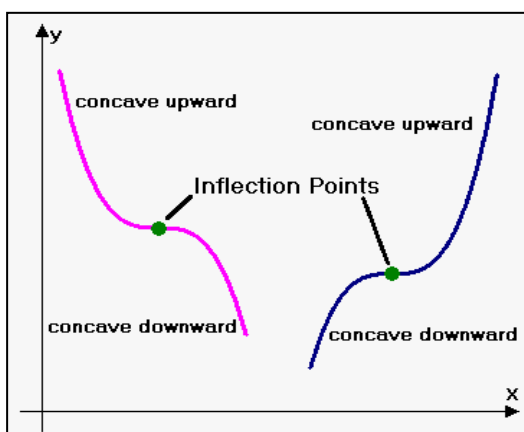
4) The domain of a cubic function is the set of all real numbers.
5) The range of a cubic function is the set of all real numbers.

Note

1) Some observations:
   - ❖ If the coefficient of x^3 gets larger, the graph of the basic cubic function is steeper (narrower), close to the y – axis.
   - ❖ If the coefficient of x^3 gets smaller, the graph of the basic cubic functions is wider (flatter), further from the y – axis.
   - ❖ If the coefficient of x^3 is negative, the graph of the basic cubic function is inverted.

$y = 5x^3$

$y = x^3$

$y = \frac{1}{5}x^3$
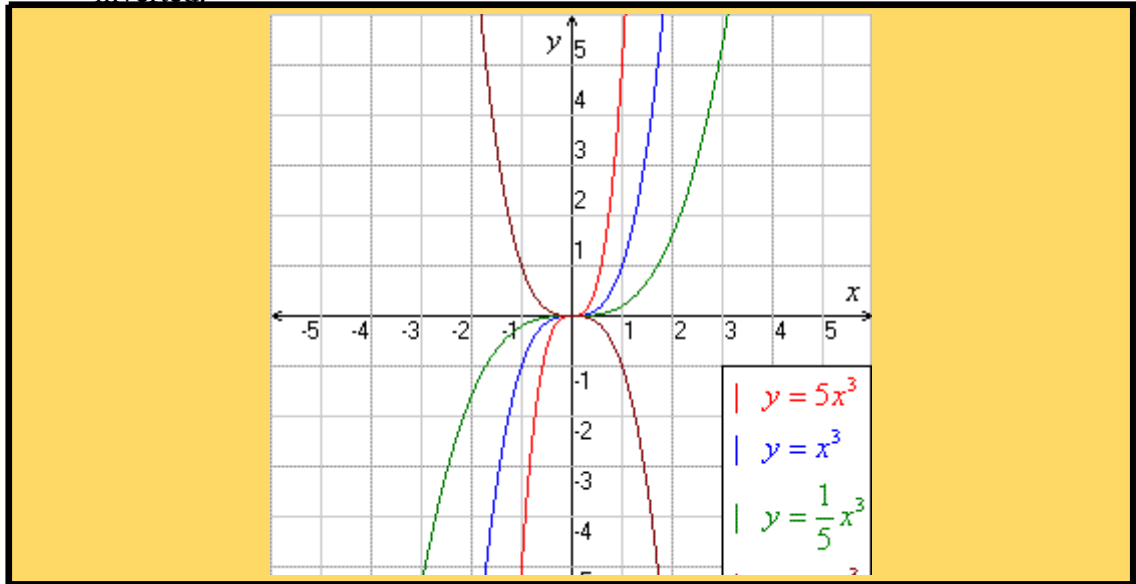
2) Shapes of cubic graphs:

Graph	Positive Shape	Negative Shape
Graph of basic cubic function $y = \pm x^3$	Graph of $f(x) = x^3$.	Graph of $f(x) = -x^3$.

Example 1:

The basic cubic function is given by $f(x) = x^3$

a) **Find the x and y intercept of the graph of f(x)**

y-intercept: Let x = 0

$f(x) = x^3$

$y = x^3$

x-intercept: Let y = 0

$f(x) = x^3$

$y = x^3$

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b) Sketch the graph of f(x)

x	-2	-1	0	1	2
y	-8	-1	0	1	8

$f(x) = x^3$

$y = x^3$

$x = -2$

$y = x^3$

$f(x) = x^3$

$y = x^3$

$x = -1$

$y = x^3$

$f(x) = x^3$

$y = x^3$

$x = 0$

$y = x^3$

$f(x) = x^3$

$y = x^3$

$x = 1$

$y = x^3$

$f(x) = x^3$

$y = x^3$

$x = 2$

$y = x^3$

$f(x) = x^3$
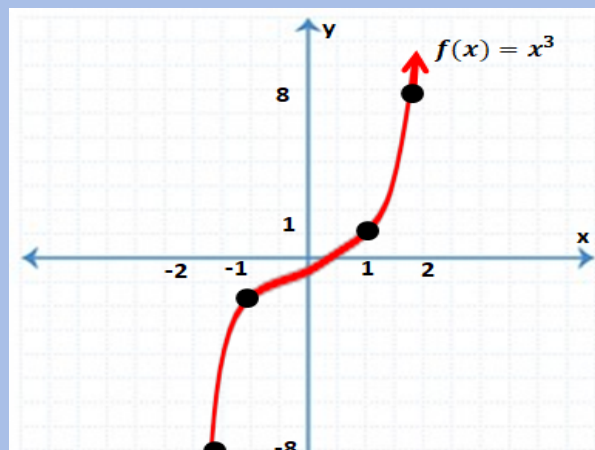
c) find the domain and range of f(x)

$Domain = \{ x : x \quad R \}$

Example 2:

Example 2:

f(x) is a cubic function given by $f(x) = -(x-2)^3$

a) Find the x and y intercept of the graph of f(x)

y-intercept: Let x = 0

$f(x) = -(x-2)^3$

$y = -(x-2)^3$

x-intercept: Let y = 0
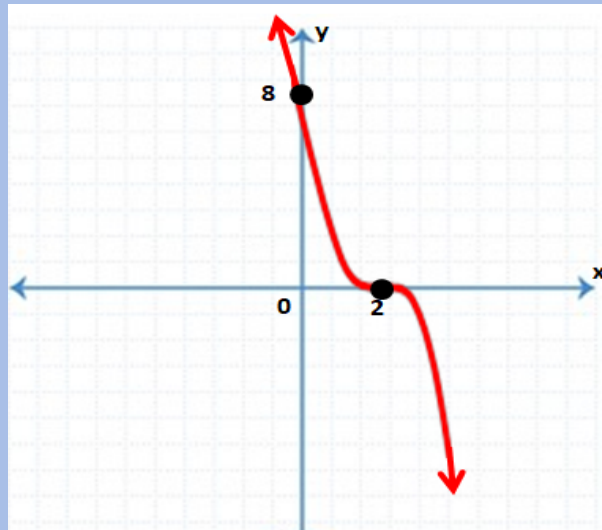
$f(x) = -(x-2)^3$

$y = -(x-2)^3$

$0 = x - 2$

$0 + 2 = x - 2 + 2$

b) Sketch the graph of f(x)

$f(x) = -(x-2)^3$

Odd power $\therefore$ point of inflection at $x = 2$
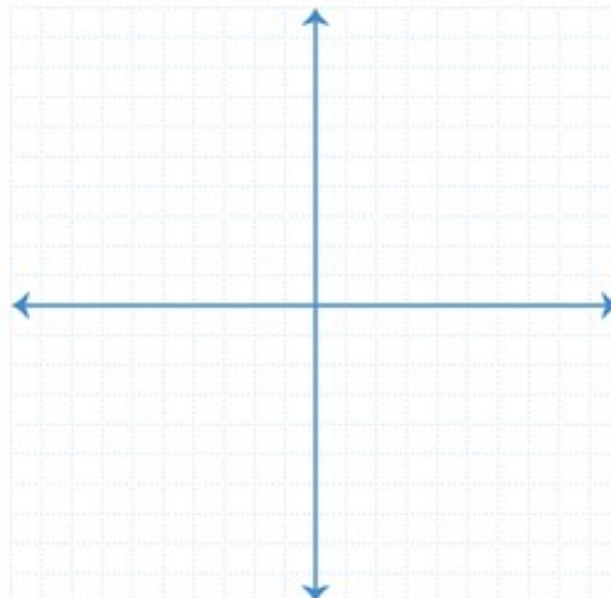
Shape $\rightarrow$ ^-ve $\therefore$

c) find the domain and range of f(x)

$Domain = \{ x : x \quad R \}$

Exercise: Sketch the graph of each of the following. Show all intercepts clearly.

1) $y = (x+4)^3$

2) $y = -(x-3)^3$