22 / 8 / 16

Graphs of Related Functions - Lesson 3

Functional Transformations - Combinations

LI

- Know that the order in which functions are transformed sometimes matters.
- Sketch graphs of functions that involve a combination of shifts and scalings.

SC

- Know the standard transformations (shifts and scalings).

Jan 10-12:11

How Coordinates Change Under Translations and Scalings

x - translation of a

$(x, y) \longrightarrow (x + a, y)$

y - translation of a

$(x, y) \longrightarrow (x, y + a)$

y - scaling of a

$(x, y) \longrightarrow (x, a\,y)$

x - scaling of a

$(x, y) \longrightarrow (x / a, y)$

Sep 5-08:15

The **order** in which transformations are done does not matter apart from 2 cases :

- x-translation with x-scaling.
- y-translation with y-scaling.

Given the function $y = f(x)$, to sketch

$$y = P\, f(Q(x + R)) + S,$$

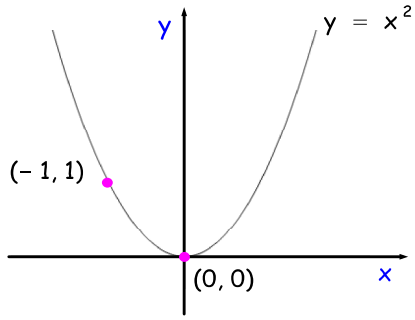
do the steps in the following order :

- $y = f(x)$ is x - scaled to $y = f(Q\,x)$.
- $y = f(Q\,x)$ is x - translated to $y = f(Q(x + R))$.
- $y = f(Q(x + R))$ is y - scaled to $y = P\, f(Q(x + R))$.
- $y = P\, f(Q(x + R))$ is y - translated to $y = P\, f(Q(x + R)) + S$.

Sep 5-07:53

Example 1

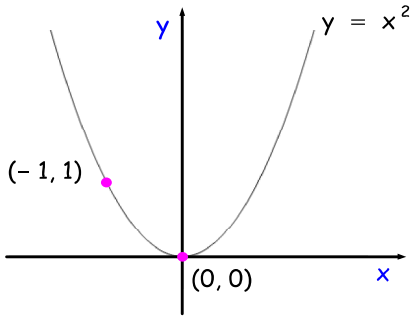
Shown below is the graph of $y = x^2$.

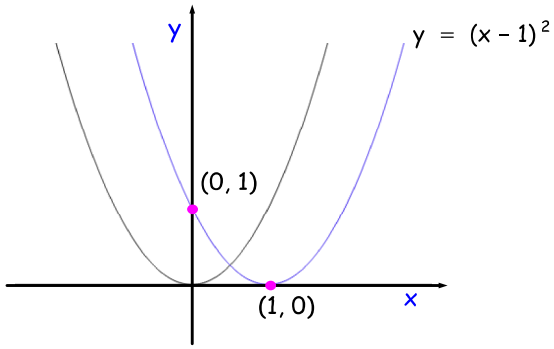


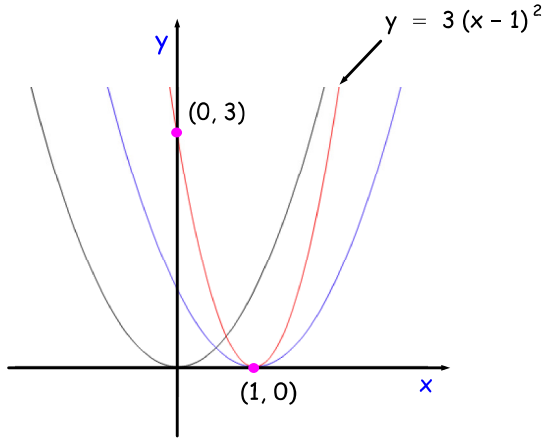
Sketch the graph of $y = 3(x - 1)^2$.

Strategy :

- $y = x^2$.
- $y = (x - 1)^2$.
- $y = 3(x - 1)^2$.







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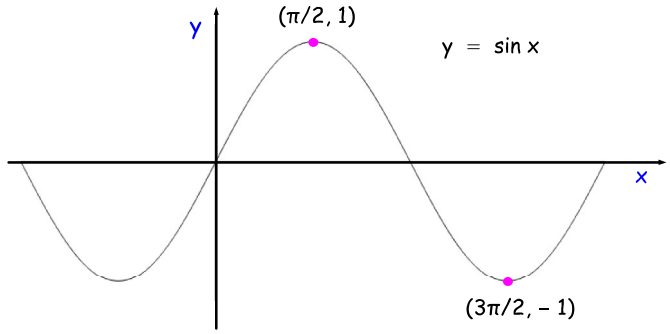
Example 2

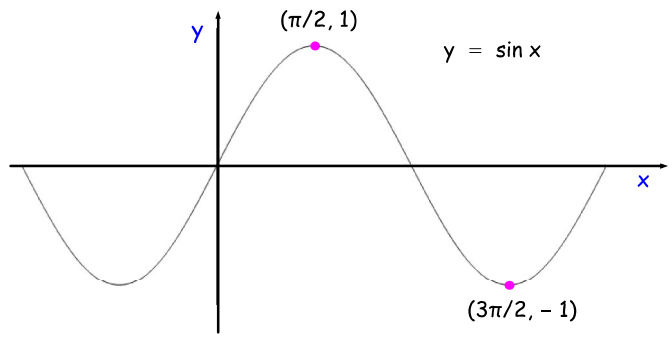
Shown below is the graph of $y = \sin x$ $(-\pi \le x \le 2\pi)$.

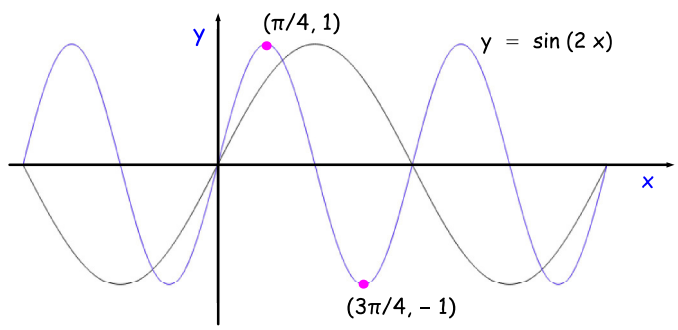


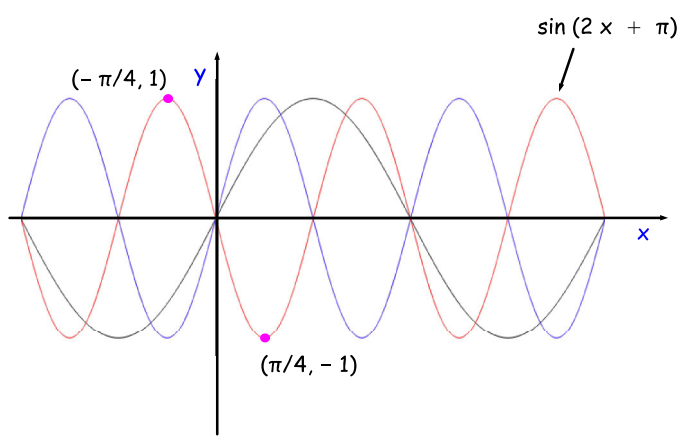
Sketch the graph of $y = \sin(2x + \pi)$.

Strategy :

- $y = \sin x$.
- $y = \sin(2x)$.
- $y = \sin(2x + \pi) = \sin(2(x + \pi/2))$.







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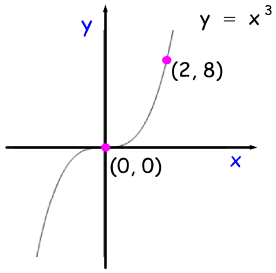
Example 3

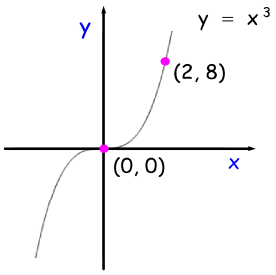
Shown below is the graph of $y = x^3$.

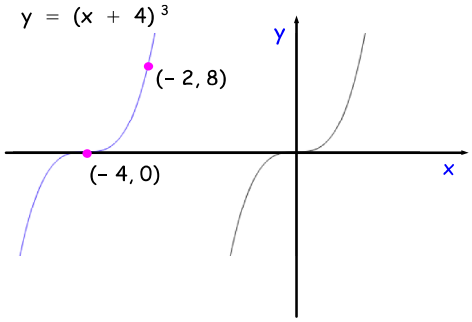


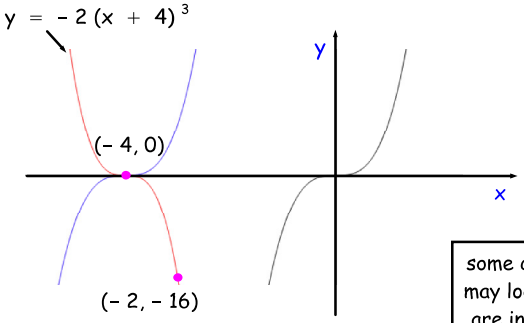
Sketch the graph of $y = 1 - 2(x + 4)^3$.

Strategy :

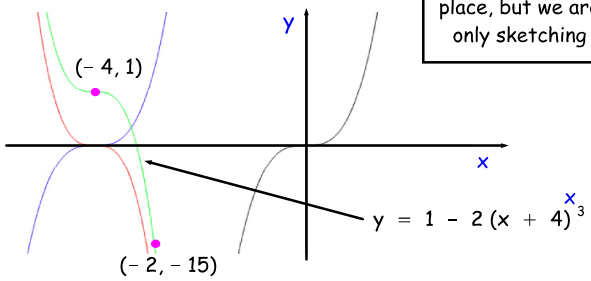
- $y = x^3$.
- $y = (x + 4)^3$.
- $y = -2(x + 4)^3$.
- $y = 1 - 2(x + 4)^3$.







some coordinates may look like they are in the wrong place, but we are only sketching



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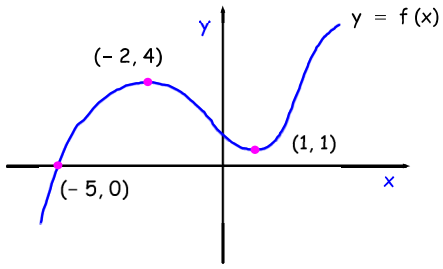
Example 4

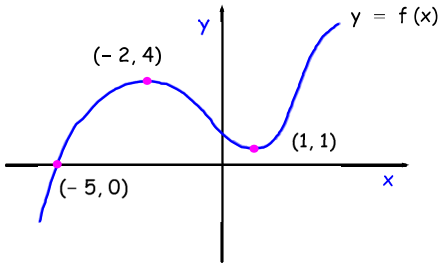
Shown below is the graph of $y = f(x)$.

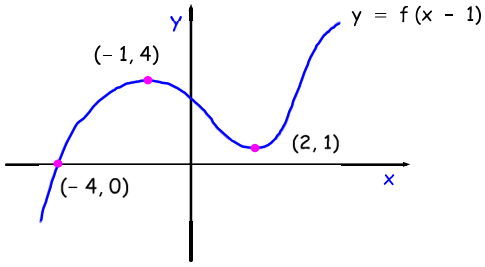


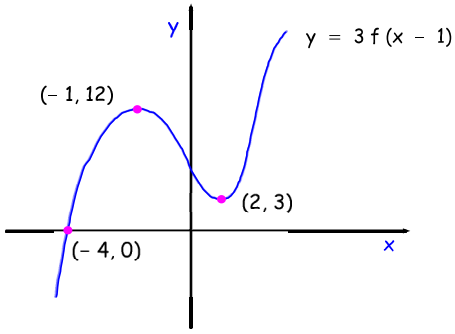
Sketch the graph of $y = 3f(x - 1) + 2$.

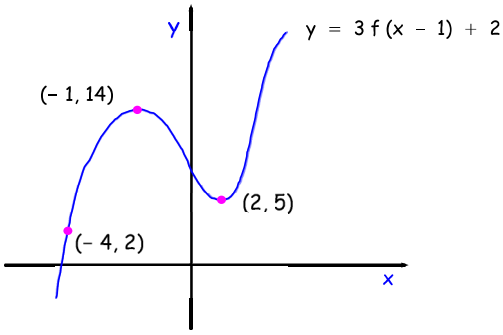
Strategy :

- $y = f(x)$.
- $y = f(x - 1)$.
- $y = 3f(x - 1)$.
- $y = 3f(x - 1) + 2$.









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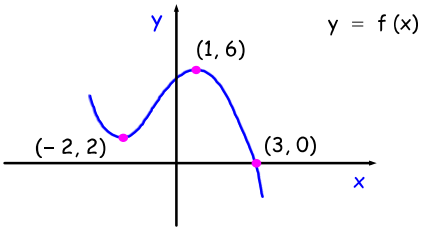
Example 5

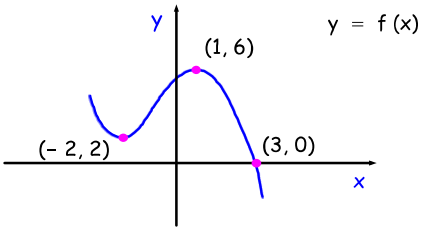
Shown below is the graph of $y = f(x)$.

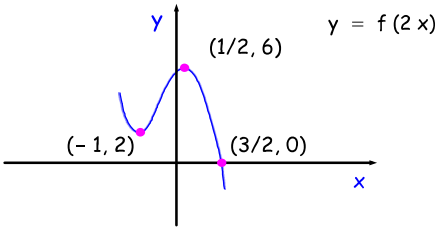


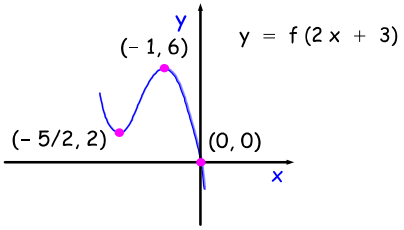
Sketch the graph of $y = 1 - f(2x + 3)$.

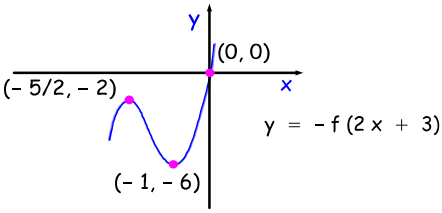
Strategy :

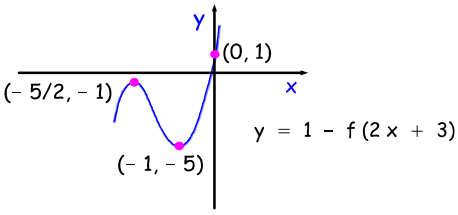
- $y = f(x)$.
- $y = f(2x)$.
- $y = f(2x + 3)$.
- $y = -f(2x + 3)$.
- $y = 1 - f(2x + 3) = 1 - f(2(x + 3/2))$.











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pg. 58 - 59 Ex. 3A All Q

Oct 29-09:14