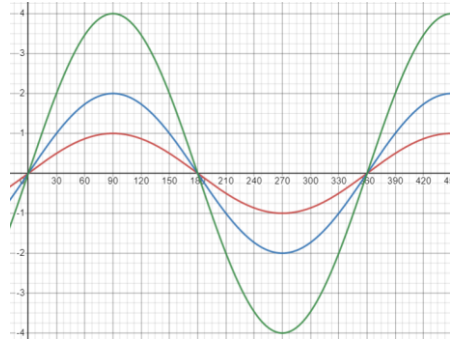


Investigating Transformations of Non-Linear Graphs

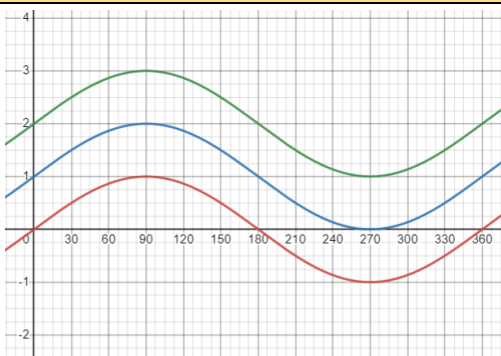
Use Desmos Graphing Calculator with a y -axis scale that goes from -4 to $+4$ and an x -axis scale in degrees that goes from -150 to $+450$.

Task 1



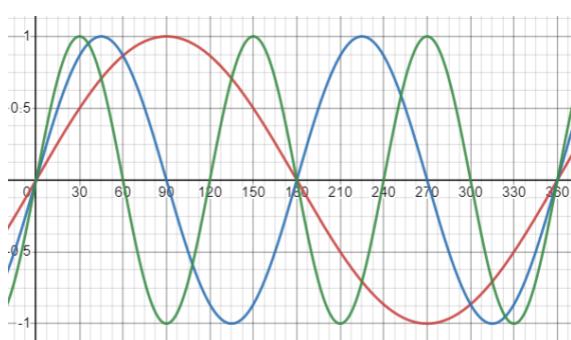
- The coordinate $(90, 1)$ maps to $(90, 2)$ and $(90, 4)$
- For $y = \sin x \rightarrow y = 2 \sin x$ the y -coordinate is multiplied by 2
- For $y = \sin x \rightarrow y = 4 \sin x$ the y -coordinate is multiplied by 4
- More generally, for $y = \sin x \rightarrow y = a \sin x$ the y -coordinate is multiplied by a

Task 2



- The coordinate $(90, 1)$ maps to $(90, 2)$ and $(90, 3)$
- For $y = \sin x \rightarrow y = \sin x + 1$ the y -coordinate is increased by 1
- For $y = \sin x \rightarrow y = \sin x + 2$ the y -coordinate is increased by 2
- More generally, for $y = \sin x \rightarrow y = \sin x + a$ the y -coordinate is increased by a

Task 3



- The coordinate $(90, 1)$ maps to $(45, 1)$ and $(30, 1)$
- For $y = \sin x \rightarrow y = \sin 2x$ the x -coordinate is divided by 2
- For $y = \sin x \rightarrow y = \sin 3x$ the x -coordinate is divided by 3
- More generally, for $y = \sin x \rightarrow y = \sin ax$ the x -coordinate is divided by a

Task 4

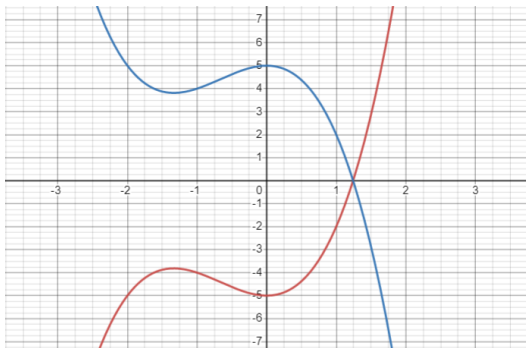


- The coordinate $(90, 1)$ maps to $(60, 1)$ and $(30, 1)$
- For $y = \sin x \rightarrow y = \sin(x + 30)$ the x -coordinate is decreased by 30
- For $y = \sin x \rightarrow y = \sin(x + 60)$ the x -coordinate is decreased by 60
- More generally, for $y = \sin x \rightarrow y = \sin(x + a)$ the x -coordinate is decreased by a

Investigating Transformations of Non-Linear Graphs

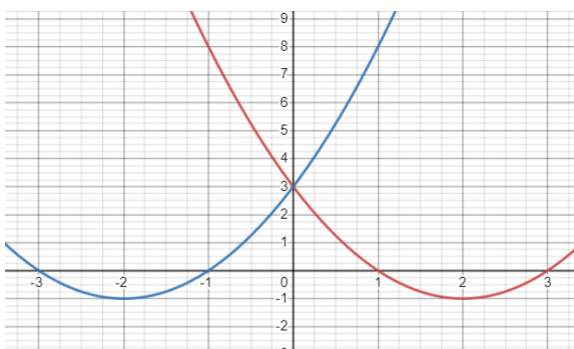
Change your scale so it now has y -axis scale that goes from -10 to $+10$ and an x -axis scale that goes from -10 to $+10$.

Task 5



- The coordinate $(1, -2)$ maps to $(1, 2)$
- For $y = x^3 + 2x^2 - 5 \rightarrow y = -(x^3 + 2x^2 - 5)$ the y -coordinate is multiplied by -1
- More generally, for $y = f(x) \rightarrow y = -f(x)$ the y -coordinate is multiplied by -1

Task 6



- The coordinate $(4, 3)$ maps to $(-4, 3)$
- For $y = x^2 - 4x + 3 \rightarrow y = (-x)^2 - 4(-x) + 3$ the x -coordinate is multiplied by -1
- More generally, for $y = f(x) \rightarrow y = f(-x)$ the x -coordinate is multiplied by -1

Challenge

Using what you have learned, **sketch** the following graphs, then use Desmos to check your answers. You will need to go back to the original scale for this challenge.

- (a) $y = \cos(x)$ (b) $y = \cos(x) - 2$ (c) $y = 4 \cos(x)$
(d) $y = \cos(2x)$ (e) $y = \cos(x + 90)$ (f) $y = -\cos(x)$
(g) $y = \cos(-x)$ (h) $y = 4 \cos(x) + 2$