Activity 20 Trigonometric graph transformations

1. $y = \sin x$:

   x-intercepts at multiples of $180°$
   y-intercept at the origin
   period $360°$
   amplitude 1 unit

2. $y = a\sin x$ Vertical dilation by factor a.
3. $y = \sin x + v$ Vertical translation v units.
4. $y = \sin(bx)$ Horizontal dilation factor $\frac{1}{b}$.
5. $y = \sin(x + h)$ Horizontal translation $-h$ units.
6. Note: Other answers are possible.

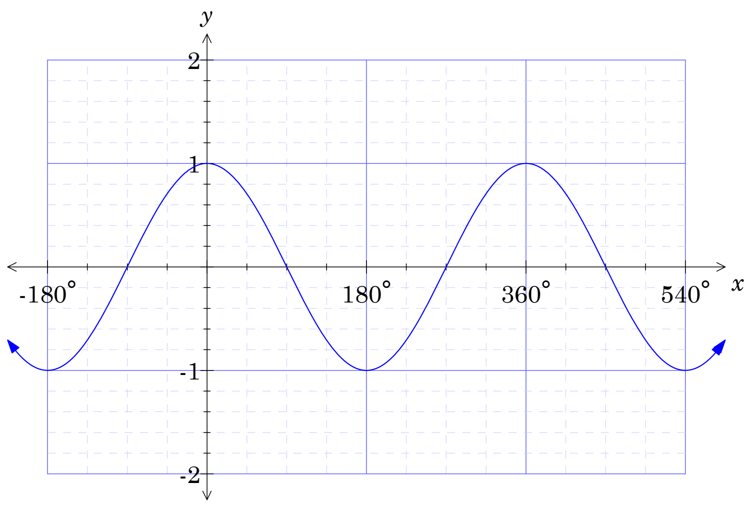
   a) $y = 2\sin(3x)$

   b) $y = 3\sin(x - 30°)$

   c) $y = \sin(2x) - 1$

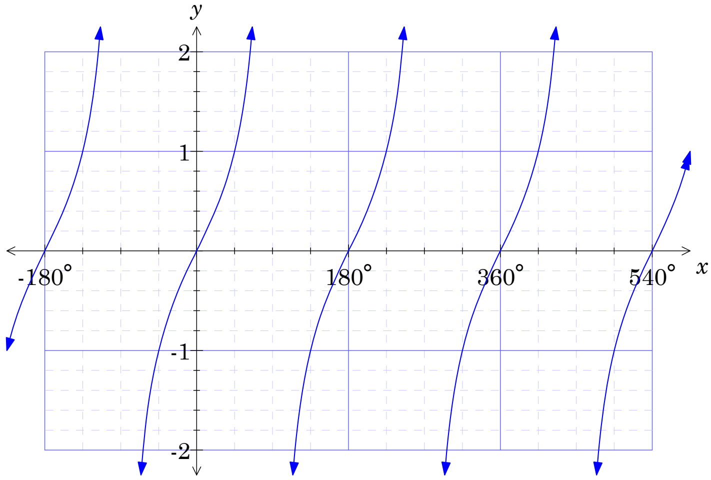
   d) $y = -\sin\left(\frac{x}{2}\right) + 1$

7. $y = \cos x$

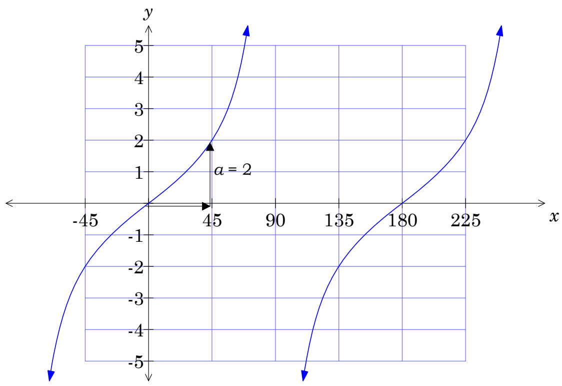


8. Transformations for $y = a \cos (b(x + h)) + v$ are the same as those for the sine function above.

9. $y = \tan x$



10. Transformations are the same as those for sine and cosine. Note that the *a* value can be determined by looking at the vertical movement required to move to the right from a point of inflection to a point halfway to the asymptote. For example, the graph below shows $y = 2\tan x$:



11. a) $y = \tan(x + 30°)$

b) $y = \tan(3x) - 2$

12. to 14. Transformations to all functions in radians are the same as those for degrees. Care must be taken with horizontal dilations. In general, *b* represents the number of cycles in $360°$, i.e. 2π radians for the sine and cosine functions, and the number of cycles in $180°$ for tangent.

15. a) $y = 3\cos\left(2\left(x - \frac{\pi}{6}\right)\right)$

b) $y = -4\sin(3x)$

c) $y = 0.5\tan(3x)$

d) $y = 0.8\cos\left(\frac{\pi x}{4}\right)$