

Trig Graphing - WS 2
Sine and Cosine Graphs with all Transformations

Name Key

Without graphing, describe in words the relationship between each pair of graphs. Include in your explanation differences you might notice in amplitude, period, reflection, vertical shift, phase shift, etc. (Use vocabulary!)

1) $f(x) = \sin x$ and $g(x) = \sin(x - \pi)$ phase shift right π

2) $f(x) = \cos x$ and $g(x) = \cos(x + \pi)$ phase shift left π

3) $f(x) = \sin x$ and $g(x) = 4 + \sin x$ vertical shift up 4

4) $f(x) = \cos x$ and $g(x) = -6 + \cos 4x$ period is $\frac{\pi}{2}$ and vertical shift down 6
 Period = $\frac{2\pi}{b} = \frac{2\pi}{4} = \frac{\pi}{2}$

State the amplitude, period, phase shift and vertical shift of each of the following functions. Then graph one complete period of each, remembering to label the tick divisions on both your horizontal axis and vertical axis. Also state the domain and range of one period using interval notation. ** Remember: $\theta \rightarrow$ degrees and $x \rightarrow$ radians. **

5) $y = \sin\left(x - \frac{\pi}{4}\right)$

6) $y = 6\cos\left(x + \frac{\pi}{6}\right)$

7) $y = 2\sin(\theta + 90^\circ)$

8) $y = 7\cos 3\theta - 2$

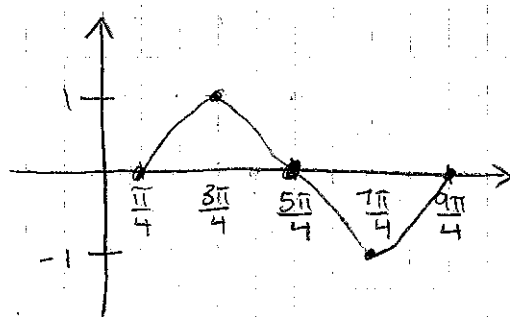
9) $y = 3\sin\left(2x - \frac{\pi}{2}\right) + 2$

10) $y = \sin(3\theta - 90^\circ)$

$$5. y = \sin(x - \frac{\pi}{4})$$

$$x - \frac{\pi}{4} = 0 \quad x - \frac{\pi}{4} = 2\pi$$

$$x = \frac{\pi}{4} \quad x = 2\frac{1}{4}\pi = \frac{9\pi}{4}$$



$$A = 1$$

$$pd = \frac{2\pi}{b} = \frac{2\pi}{1} = 2\pi$$

$$PS = \frac{\pi}{4}$$

$$VS = \text{none}$$

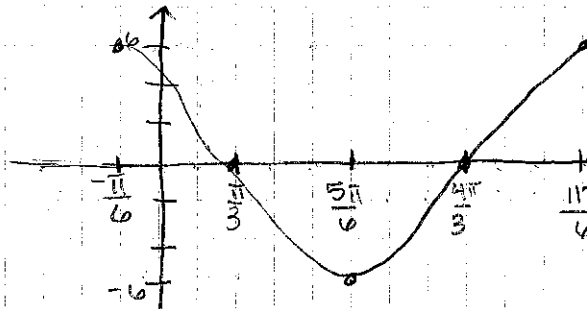
$$D: [\frac{\pi}{4}, \frac{9\pi}{4}]$$

$$R: [-1, 1]$$

$$6. y = 6 \cos(x + \frac{\pi}{6})$$

$$x + \frac{\pi}{6} = 0 \quad x + \frac{\pi}{6} = 2\pi$$

$$x = -\frac{\pi}{6} \quad x = 1\frac{5}{6}\pi = \frac{11\pi}{6}$$



$$A = 6$$

$$pd = \frac{2\pi}{b} = \frac{2\pi}{1} = 2\pi$$

$$PS = -\pi/6$$

$$VS = \text{none}$$

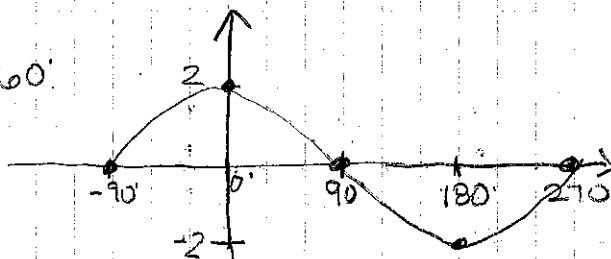
$$D: [-\pi/6, 11\pi/6]$$

$$R: [-6, 6]$$

$$7. y = 2 \sin(\theta + 90^\circ)$$

$$\theta + 90 = 0 \quad \theta + 90 = 360$$

$$\theta = -90^\circ \quad \theta = 270^\circ$$



$$A = 2$$

$$Pd = \frac{360}{b} = \frac{360}{1} = 360$$

$$PS = -90^\circ$$

$$VS = \text{none}$$

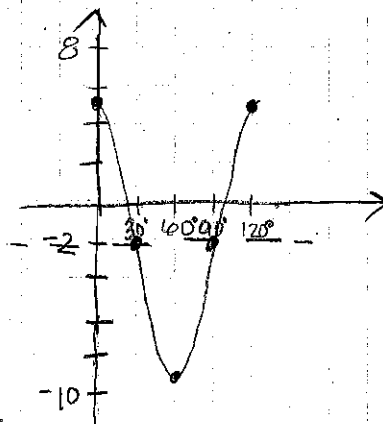
$$D: [90^\circ, 270^\circ]$$

$$R: [-2, 2]$$

$$8. y = 7 \cos 3\theta - 2$$

$$3\theta = 0 \quad 3\theta = 360$$

$$\theta = 0^\circ \quad \theta = 120^\circ$$



$$A = 7$$

$$Pd = \frac{360}{b} = \frac{360}{3} = 120$$

$$PS = \text{none}$$

$$VS = -2$$

$$D: [0^\circ, 120^\circ]$$

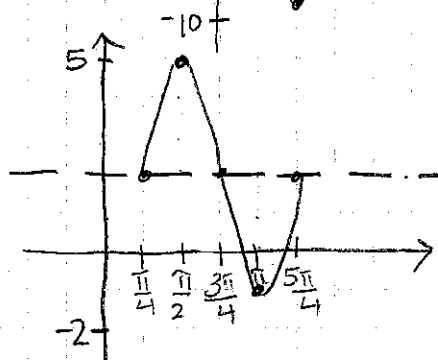
$$R: [-9, 5]$$

$$9. y = 3 \sin(2x - \frac{\pi}{2}) + 2$$

$$2x - \frac{\pi}{2} = 0 \quad 2x - \frac{\pi}{2} = 2\pi$$

$$2x = \frac{\pi}{2} \quad 2x = \frac{5\pi}{2}$$

$$x = \frac{\pi}{4} \quad x = \frac{5\pi}{4}$$



$$A = 3$$

$$pd = \frac{2\pi}{b} = \pi$$

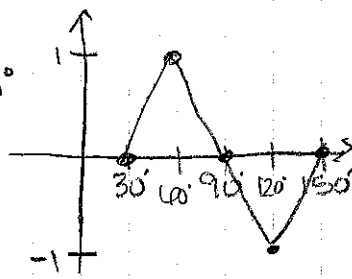
$$PS = \frac{\pi}{4}$$

$$VS = 2$$

$$D: [\frac{\pi}{4}, \frac{5\pi}{4}]$$

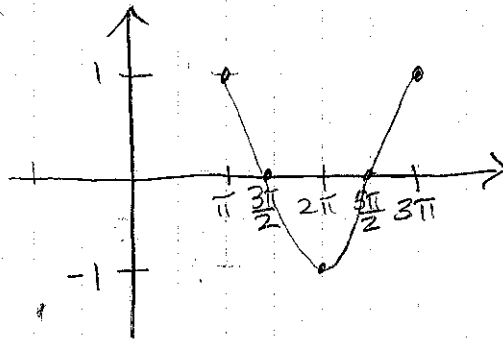
$$R: [-1, 5]$$

10. $y = \sin(3\theta - 90^\circ)$
 $3\theta - 90 = 0$ $3\theta - 90 = 360$
 $3\theta = 90$ $3\theta = 450$
 $\theta = 30^\circ$ $\theta = 150^\circ$



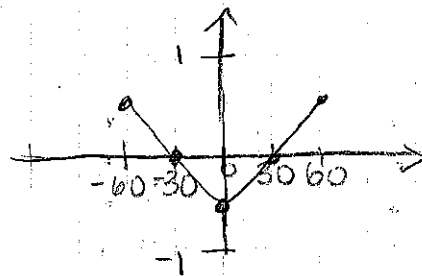
$A = 1$
 $Pd = \frac{360}{3} = 120^\circ$
 $PS = 30^\circ$
 $VS = \text{none}$
 $D = [30^\circ, 150^\circ]$
 $R = [-1, 1]$

11. $y = \cos(-x + \pi)$
 $y = \cos(-(x - \pi))$
 $y = \cos(x - \pi)$
 $x - \pi = 0$ $x - \pi = 2\pi$
 $x = \pi$ $x = 3\pi$



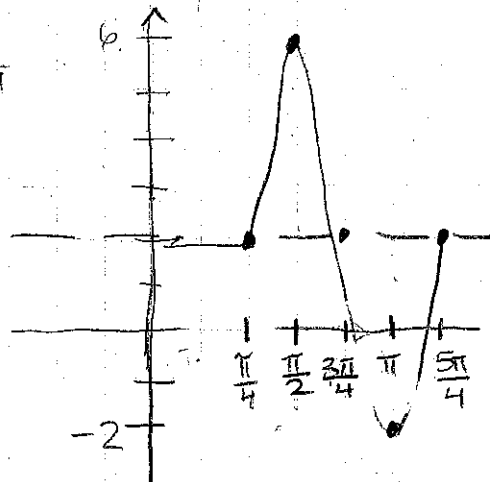
$A = 1$
 $Pd = \left| \frac{2\pi}{1} \right| = |2\pi| = 2\pi$
 $PS = \pi$
 $VS = \text{none}$
 $D = [\pi, 3\pi]$
 $R = [-1, 1]$

12. $y = \frac{1}{2} \cos(3\theta + 180^\circ)$
 $3\theta + 180 = 0$ $3\theta + 180 = 360$
 $3\theta = -180$ $3\theta = 180$
 $\theta = -60^\circ$ $\theta = 60^\circ$



$A = 1/2$
 $Pd = \frac{360}{3} = 120^\circ$
 $PS = -60^\circ$
 $VS = \text{none}$
 $D = [-60^\circ, 60^\circ]$
 $R = [-1/2, 1/2]$

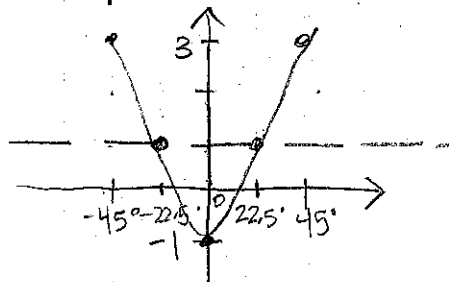
13. $y = 4 \sin(2x - \frac{\pi}{2}) + 2$
 $2x - \frac{\pi}{2} = 0$ $2x - \frac{\pi}{2} = 2\pi$
 $2x = \frac{\pi}{2}$ $2x = \frac{5\pi}{2}$
 $x = \frac{\pi}{4}$ $x = \frac{5\pi}{4}$



$A = 4$
 $Pd = \frac{2\pi}{2} = \pi$
 $PS = \pi/4$
 $VS = 2$
 $D: [\pi/4, 5\pi/4]$
 $R: [-2, 6]$

14 (next page - Sorry!)

15. $y = 2 \cos(4\theta + 180^\circ) + 1$
 $4\theta + 180 = 0$ $4\theta + 180 = 360$
 $4\theta = 180$ $4\theta = 180$
 $\theta = 45^\circ$ $\theta = 45^\circ$



$A = 2$
 $Pd = \frac{360}{4} = 90^\circ$
 $PS = -45^\circ$
 $VS = 1$
 $D: [-45^\circ, 45^\circ]$
 $R: [-1, 3]$

$$14. y = -5 \sin\left(\frac{x}{2} + \frac{\pi}{2}\right) - 3$$

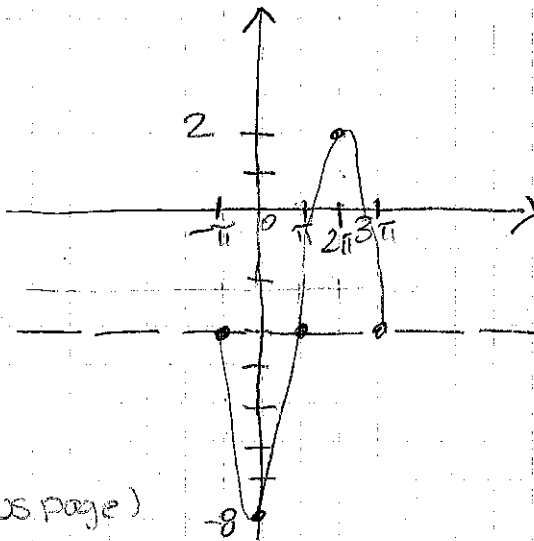
$$\frac{x}{2} + \frac{\pi}{2} = 0 \quad \frac{x}{2} + \frac{\pi}{2} = 2\pi$$

$$\frac{x}{2} = -\frac{\pi}{2}$$

$$x = -\pi$$

$$\frac{x}{2} = \frac{3\pi}{2}$$

$$x = 3\pi$$



$$A = 5$$

$$Pd = \frac{2\pi}{1/2} = 2\pi \cdot 2 = 4\pi$$

$$PS = -\pi$$

$$VS = +3$$

$$D: [-\pi, 3\pi]$$

$$R: [-8, 2]$$

(15: remember - was on previous page)

$$16. y = 3 \sin(8\theta - 720) - 1$$

$$8\theta - 720 = 0$$

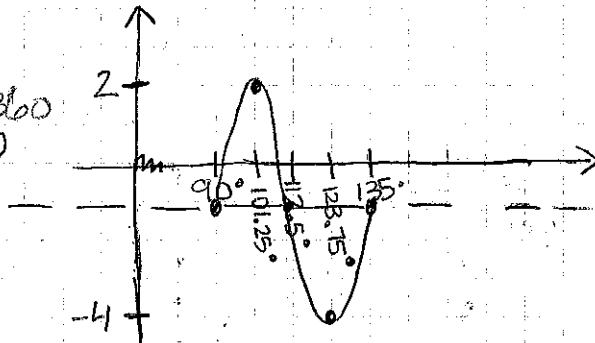
$$8\theta = 720$$

$$\theta = 90^\circ$$

$$8\theta - 720 = 360$$

$$8\theta = 1080$$

$$\theta = 135^\circ$$



$$A = 3$$

$$Pd = \frac{360}{8} = 45^\circ$$

$$PS = 90^\circ$$

$$VS = -1$$

$$D: [90, 135]$$

$$R: [-4, 2]$$

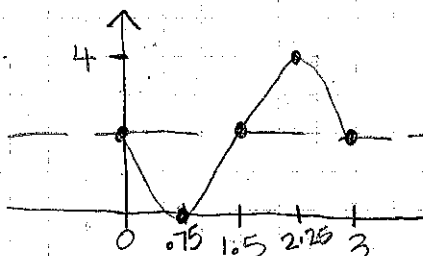
$$17. y = -2 \sin \frac{2\pi x}{3} + 2$$

$$\frac{2\pi x}{3} = 0 \quad \frac{3}{2\pi} \cdot \frac{2\pi x}{3} = 2\pi \cdot \frac{3}{2\pi}$$

$$x = 0$$

$$x = 3$$

these are radians
(you just don't see it)



$$A = 2$$

$$Pd = \frac{2\pi}{2\pi/3} = 2\pi \cdot \frac{3}{2\pi} = 3$$

$$PS = 0$$

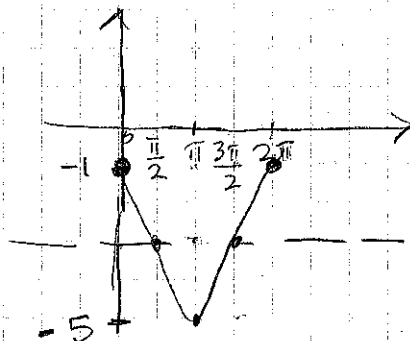
$$VS = 2$$

$$D: [0, 3]$$

$$R: [0, 4]$$

$$18. y = 2 \cos x - 3$$

$$x = 0 \quad x = 2\pi$$



$$A = 2$$

$$Pd = \frac{2\pi}{1} = 2\pi$$

$$PS = \text{none}$$

$$VS = -3$$

$$D: [0, 2\pi]$$

$$R: [-5, -1]$$

$$19. y = 2/3 \cos\left(\frac{x}{2} - \frac{\pi}{4}\right)$$

$$\frac{x}{2} - \frac{\pi}{4} = 0$$

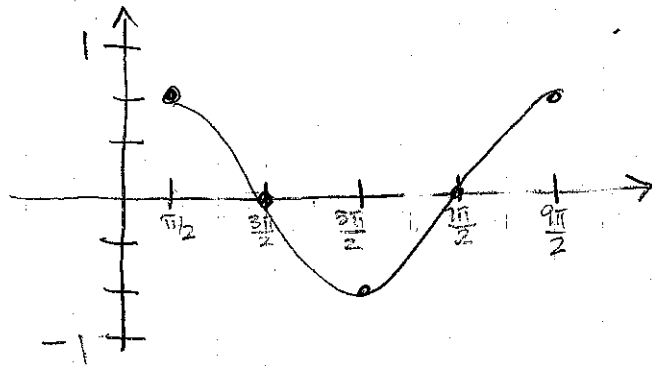
$$\frac{x}{2} = \frac{\pi}{4}$$

$$x = \frac{\pi}{2}$$

$$\frac{x}{2} - \frac{\pi}{4} = 2\pi$$

$$\frac{x}{2} = \frac{9\pi}{4}$$

$$x = \frac{9\pi}{2}$$



$$A = 2/3$$

$$Pd = \frac{2\pi}{1/2} = 2\pi \cdot 2 = 4\pi$$

$$PS = \pi/2$$

$$VS = \text{none}$$

$$D = \left[\frac{\pi}{2}, \frac{9\pi}{2}\right]$$

$$R = \left[-\frac{2}{3}, \frac{2}{3}\right]$$

$$20. y = -3 \cos(6x + \pi) - 2$$

$$6x + \pi = 0$$

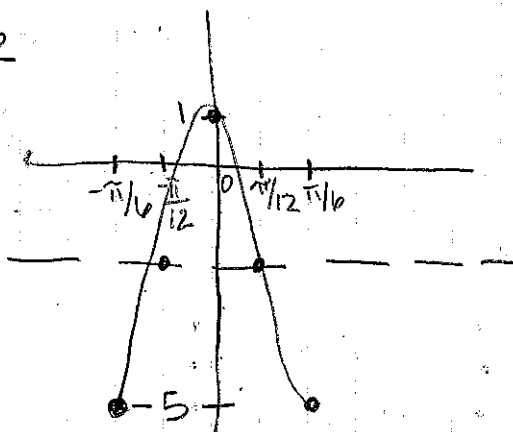
$$6x = -\pi$$

$$x = -\frac{\pi}{6}$$

$$6x + \pi = 2\pi$$

$$6x = \pi$$

$$x = \frac{\pi}{6}$$



$$A = 3$$

$$Pd = \frac{2\pi}{6} = \frac{\pi}{3}$$

$$PS = -\pi/6$$

$$VS = -2$$

$$D = \left[-\frac{\pi}{6}, \frac{\pi}{6}\right]$$

$$R = \left[-5, 1\right]$$