

## MHF 4U1 – Problem Set # 31 – Sine and Cosine Transformations

1. Draw the following graphs and state the amplitude, period and phase shift for each:

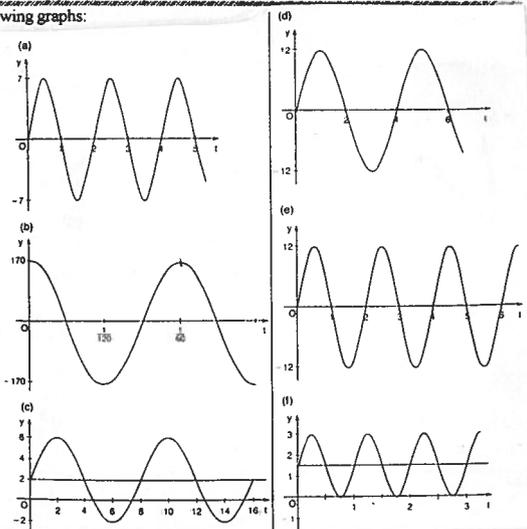
a)  $y = \sin\left(\theta + \frac{\pi}{2}\right)$  ( $-\pi \leq \theta \leq 2\pi$ )    b)  $y = 3 \cos\left(\theta - \frac{\pi}{2}\right)$  ( $-\pi \leq \theta \leq 2\pi$ )    c)  $y = -2 \sin(3\theta)$  ( $-\pi \leq \theta \leq 2\pi$ )

d)  $y = \frac{1}{2} \cos 2\left(\theta + \frac{\pi}{4}\right)$  ( $-\pi \leq \theta \leq 2\pi$ )    e)  $y = -\frac{1}{2} \sin 3\left(\theta - \frac{\pi}{6}\right) + 1$  ( $-\pi \leq \theta \leq 2\pi$ )    f)  $y = -3 \cos\left(\theta + \frac{\pi}{4}\right) - 1$  ( $-\pi \leq \theta \leq 2\pi$ )

g)  $y = \sin\left(2\theta + \frac{\pi}{3}\right)$  ( $-\pi \leq \theta \leq 2\pi$ )    h)  $y = 2 \cos\left(3\theta - \frac{\pi}{2}\right)$  ( $-\pi \leq \theta \leq 2\pi$ )    i)  $y = -2 \sin\left(3\theta - \frac{3\pi}{4}\right)$  ( $-\pi \leq \theta \leq \pi$ )

## MHF 4U1 – Problem Set # 32 – Sine and Cosine Applications

1. State the defining equations for each of the following graphs:



- What is the cosine function with a period of  $\frac{\pi}{2}$ , shifted down 4 and left 45 degrees?
- A ferris wheel has a diameter of 40m and rotates once every 24s.
  - Draw a graph to show a person's height above or below the centre of rotation starting at the lowest position.
  - Find an equation of the graph.
- During a spring tide on a river, readings were taken and a range of 15m was reported. Assuming the height of water with respect to sea level is a sine function.
  - Draw a graph of the height of water over a 24 hour period. (Assume a cycle every 12 hours)
  - Find an equation for the graph.
- A household alternating current varies from -155V to 155V with a frequency of 60 Hz (1 Hz = 1 cycle per second)
  - Draw a graph showing at least 2 cycles
  - Find an equation that describes alternating current.
- A mass is suspended from a spring and allowed to bounce up or down. The distance from the high point to the low point is 20 cm and it takes 4s to complete 5 cycles. The distance from the position of rest with respect to time is modelled by a sine function for the first few cycles.
  - Draw a graph of the sine function.
  - Write an equation that best represents the distance from the rest position with respect to time.
- A water wheel has a radius of 3m and rotates once every 12s. The bottom of the wheel is 1 m above the water.
  - Draw a graph to show the height above the ground of a position level with the centre.
  - Find an equation of the graph.