

Name:

Worksheet 4, Math 1113

Show all your working and label your answer clearly.

1. Given  $\cos(\frac{17\pi}{12}) = -\frac{\sqrt{3}-1}{2\sqrt{2}}$ , find another angle  $\theta$  between 0 and  $2\pi$  such that

$$\cos(\theta) = -\frac{\sqrt{3}-1}{2\sqrt{2}}$$

From periodicity of  $\cos(\theta)$ , we have

$$\cos\left(\frac{17\pi}{12} - 2\pi\right) = \cos\left(\frac{17\pi}{12}\right)$$

$$\cos\left(-\frac{7\pi}{12}\right) = \cos\left(\frac{17\pi}{12}\right)$$

Moreover,  $\cos(\theta)$  is even, so

$$\cos\left(\frac{7\pi}{12}\right) = \cos\left(-\frac{7\pi}{12}\right) = \cos\left(\frac{17\pi}{12}\right) = -\frac{\sqrt{3}-1}{2\sqrt{2}}$$

$$\text{so } \theta = \frac{7\pi}{12}.$$

2. Given  $\sin(\theta) = 0.2$  with  $\theta$  in the second quadrant, find  $\cos(\theta)$  and  $\tan(\theta)$ .

We have

$$(\cos(\theta))^2 + (\sin(\theta))^2 = 1.$$

$$(\cos(\theta))^2 + (0.2)^2 = 1$$

$$(\cos(\theta))^2 = 0.96$$

$$\cos(\theta) = \pm \sqrt{0.96}$$

Now we want  $\theta$  is the second quad. so  $\cos(\theta) \leq 0$ .

so

$$\cos(\theta) = -\sqrt{0.96}$$

Finally,

$$\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)} = -\frac{0.2}{\sqrt{0.96}}$$

3. A winch on a sailboat has a diameter of 20cm. To take up 3m of slack, how many times do you need to rotate it?

Let  $r = 10$  (radius in cm)

$S = 300$  (length of slack in cm)

Since the amount of slack is going to be the arclength, we have

$$\theta = \frac{S}{r} = \frac{300}{10} = 30 \text{ radians.}$$

so  $\frac{30}{2\pi}$  rotations is needed.