Print and sign a brief statement stating this is your work and you used no other resource:

Name (sign): _____ Name (print): _____

Student Number: _____

Instructor's Name: _____ Class Time: _____

Problem Number	Points Possible	Points Made
??	0	
??	15	
??	30	
??	20	
??	15	
??	20	
Total:	100	

- If you need extra space use the last page.
- Please show your work. **An unjustified answer may receive little or no credit.**
- If you make use of a theorem to justify a conclusion then state the theorem used by name.
- Your work must be **neat**. This will make it easier to properly grade and give you the credit you deserve.
- The total number of possible points that is assigned for each problem is shown here. The number of points for each subproblem is shown within the exam.
- Please turn off your mobile phone.
- A calculator is not necessary, but numerical answers should be given in a form that can be directly entered into a calculator.

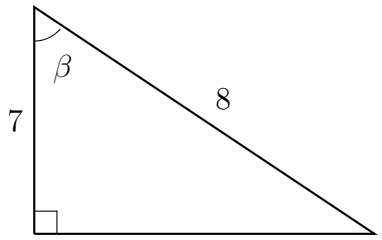
Common identities:

$$\cos(\alpha+\beta)=\cos(\alpha)\cos(\beta)-\sin(\alpha)\sin(\beta), \qquad \sin(\alpha+\beta) \;=\sin(\alpha)\cos(\beta)+\cos(\alpha)\sin(\beta).$$

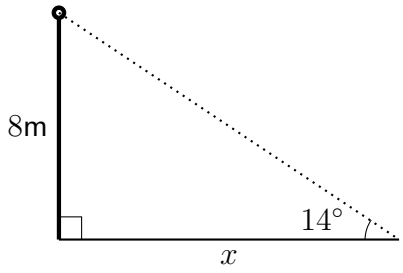
1. Common Knowledge: What was the key moment at Paris-Roubaix that made the win possible?

2. Determine the values of the requested quantities in each question below. All values should be either exact or within 0.01 of the true value. (**All angles are given in radians and should be expressed in radians if you have to determine their value**.)

   (a) Determine the sine, cosine, and tangent of the angle β in the diagram below.

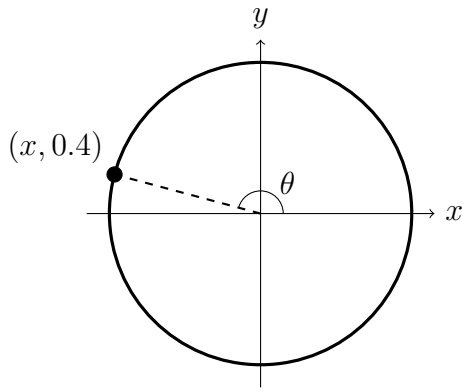


   (b) A wire is attached to the top of an eight meter pole, and the wire is anchored a distance of x meters away from the base. The angle of elevation of the wire from the ground is 14° (degrees). Determine the distance between the base of the pole and the anchor point for the wire, x.

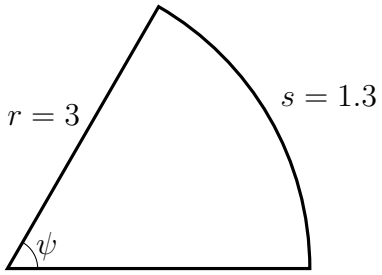


3. Determine the values of the requested quantities in each question below. All values should be either exact or within 0.01 of the true value unless otherwise stated. (**All angles are given in radians and should be expressed in radians if you have to determine their value**.)

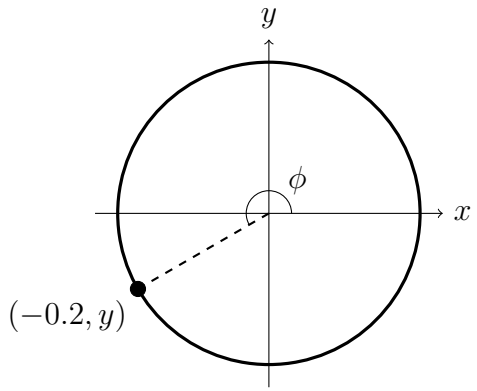
   (a) The point $(x, 0.4)$ lies on the unit circle as shown in the diagram below. Determine the values of $\cos(\theta)$, $\sin(\theta)$, and $\tan(\theta)$.



   (b) A sector is shown below, and the angle subtended by the sector is ψ. The radius of the sector is 3 units, and the arclength of the sector is 1.3 units. Determine the radian measure of the angle ψ (Provide an exact answer.)



   (c) The point, $(-0.2, y)$, is located on the unit circle as shown in the diagram below. Determine the radian measure of the angle ϕ.

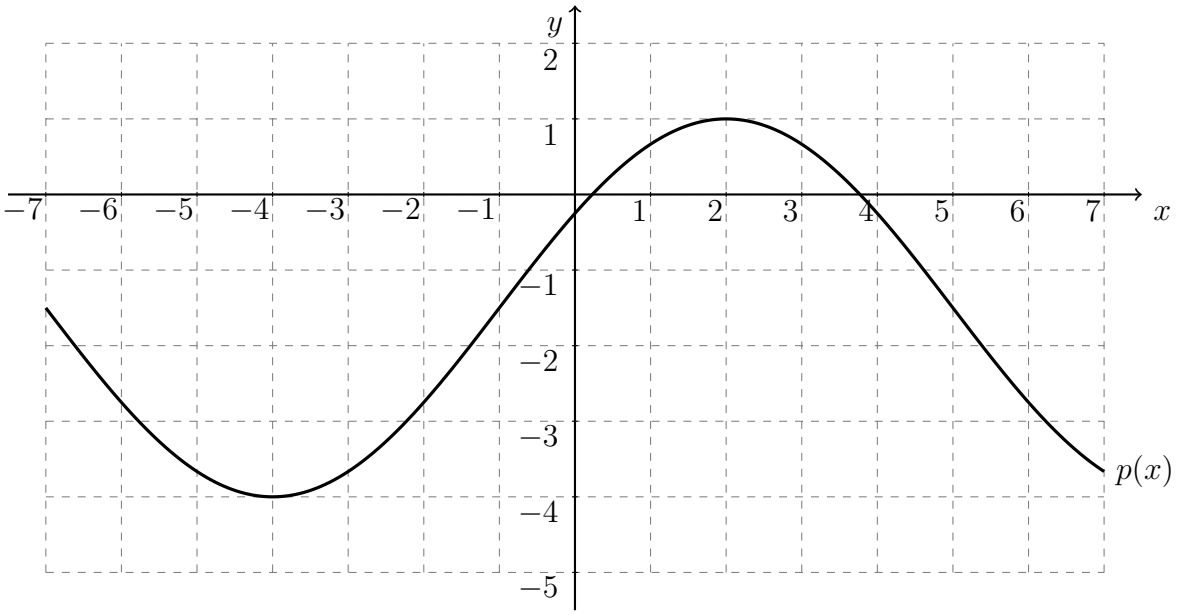


4. A local business person wants to propose an addition to the College Square renovations. The proposal will include a twenty meter pole, and during News Year Eve celebrations a giant lobster will be lowered from the top of the poll. The lobster will be lowered over ten seconds to countdown to the new year. A person standing thirty meters from the base should have a **change** in their viewing angle (the change in their angle of elevation) of ten degrees. How low should the lobster be dropped?

5. Express the function whose graph is shown below as a cosine function,

$$p(x) = A\cos(Bx + C) + D,$$

where $A > 0$ and $B > 0$.



$A =$

$B =$

$C =$

$D =$

6. The open A string on a bass should vibrate so the displacement goes through 55 cycles per second. The displacement of the string is given by

$$w(t) = 0.2 \sin\left(\left(24.4\sqrt{TE}\right)\ t\right),$$

where TE is the tension in the string in Newtons. What should the tension in the open A string be?

Extra space for work. **Do not detach this page.** If you want us to consider the work on this page you should print your name, instructor and class meeting time below.

Name (print): _____ Instructor (print): _____ Time: _____