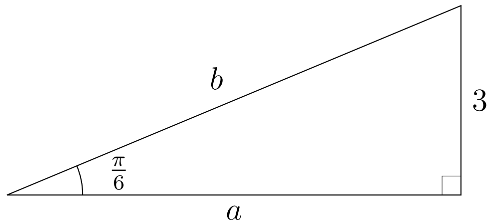
Show work for all problems; use the back of the sheet if necessary. All trigonometric evaluations used in these problems are computable values and final answers on all questions except #4 should not contain unsimplified trigonometric expressions.

1. **(4 points)** In the following right triangle (not drawn to scale), find the values of a and b. Label which is which.



Since the cosecant of an angle in a right triangle is the ratio of the hypotenuse to the opposite side, we know that

$$\frac{b}{3} = \csc\frac{\pi}{6} = 2$$

and thus $b = 6$.

Likewise, we know the cotangent of an angle is the ratio of the adjacent side to the opposite side, so

$$\frac{a}{3} = \cot\frac{\pi}{6} = \sqrt{3}$$

and thus $a = 3\sqrt{3}$.

2. **(1 point)** *Convert the angle measure* $54°$ *to radians.*

Since 2π is a full circle in radians and $360°$ is a full circle in degrees, the ratio $\frac{2\pi \text{ radians}}{360°}$ is a unit-conversion, so

$$54° = 54° \cdot \frac{2\pi \text{ radians}}{360°} = \frac{108\pi}{360} \text{ radians} = \frac{3\pi}{10} \text{ radians}$$

3. **(1 point)** *Convert the angle measure* $\frac{5\pi}{18}$ *to degrees.*

Since 2π is a full circle in radians and $360°$ is a full circle in degrees, the ratio $\frac{360°}{2\pi \text{ radians}}$ is a unit-conversion, so

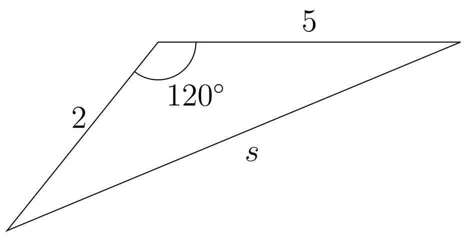
$$\frac{5\pi}{18} \text{ radians} = \left(\frac{5\pi}{18} \text{ radians}\right) \cdot \frac{360°}{2\pi \text{ radians}} = \frac{5 \cdot 360°}{36} = 50°$$

4. **(5 points)** *Verify the identity* $(\tan y + \cot y)\sin y = \sec y$.

We shall process the left side with trigonometric and algebraic rearrantgements until we get the right side:

$$\begin{aligned}
(\tan y + \cot y)\sin y &= \left(\frac{\sin y}{\cos y} + \frac{\cos y}{\sin y}\right)\sin y \\
&= \left(\frac{\sin y \sin y}{\sin y \cos y} + \frac{\cos y \cos y}{\sin y \cos y}\right)\sin y \\
&= \left(\frac{\sin^2 y + \cos^2 y}{\sin y \cos y}\right)\sin y \\
&= \frac{1}{\sin y \cos y}\sin y = \frac{1}{\cos y} = \sec y
\end{aligned}$$

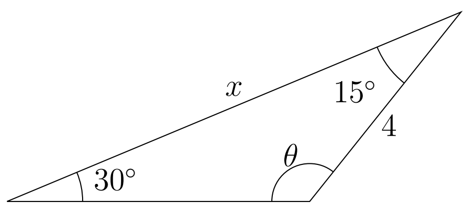
5. **(4 points)** *In the following triangle (not drawn to scale), find the value of s.*



Using the Law of Cosines:

$$\begin{aligned} s^2 &= 2^2 + 5^2 - 2 \cdot 2 \cdot 5 \cdot \cos 120^\circ \\ &= 4 + 25 - 2 \cdot 2 \cdot 5 \left(\frac{-1}{2} \right) \\ &= 39 \\ s &= \sqrt{39} \end{aligned}$$

6. **(5 points)** In the following triangle (not drawn to scale), find the values of θ and x.



Since the angles of a triangle should add up to 180°, we know that

$$30^\circ + 15^\circ + \theta = 180^\circ$$

so $\theta = 135^\circ$. Then we may use the Law of Sines to determine x:

$$\frac{x}{\sin 135^\circ} = \frac{4}{\sin 30^\circ}$$

so $x = \frac{4 \sin 135^\circ}{\sin 30^\circ} = \frac{4 \cdot \frac{\sqrt{2}}{2}}{\frac{1}{2}} = 4\sqrt{2}$.