1. **(2 points)** *Determine the value (in radians) of* $\arctan \frac{1}{\sqrt{3}}$.

   Since $\tan \frac{\pi}{6} = \frac{1}{\sqrt{3}}$ and $\frac{\pi}{6}$ is within the interval $(-\frac{\pi}{2}, \frac{\pi}{2})$, we know that $\arctan \frac{1}{\sqrt{3}} = \frac{\pi}{6}$.

2. **(3 points)** *Determine the value (in radians) of* $\arccos \frac{-1}{2}$.

   We know that the arc-cosine's range is $[0, \pi]$; the section of this interval where the cosine is negative is $(\frac{\pi}{2}, \pi]$, and $\frac{1}{2}$ is the cosine of the reference number $\frac{\pi}{3}$. We thus want a value in $(\frac{\pi}{2}, \pi]$ with reference number $\frac{\pi}{3}$, and the number in question will be $\frac{2\pi}{3}$.

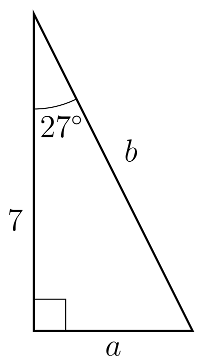
3. **(3 points)** *What is the measure, in degrees, of an angle of $\frac{7\pi}{4}$ radians?*

   There are 180 degrees in π radians, so that angle is $\frac{7 \cdot 180}{4} = 315°$.

4. **(4 points)** *Calculate* $\tan 210°$.

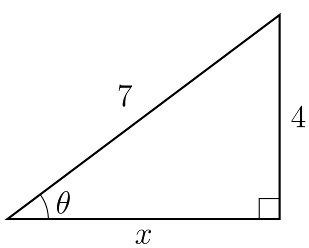
   The reference number of $210°$ is $|210° - 180°| = 30°$, so $\tan 210° = \pm \tan 30° = \pm \frac{1}{\sqrt{3}}$. Since $210°$ describes a point in the third quadrant, the desired tangent is specifically the positive possibility $\frac{1}{\sqrt{3}}$.

5. **(4 points)** Leaving your answer in terms of unsimplified trigonometric calculations on $27°$, *determine the values of the lengths a and b in the triangle below, indicating which is which.*

   We know the length of the adjacent side 7. Two relationships involving the adjacent side of this triangle are the cosine and tangent of $27°$: $\frac{7}{b} = \cos 27°$ and $\frac{a}{7} = \tan 27°$. We can then solve for the unknowns and get $b = \frac{7}{\cos 27°} = 7 \sec 27°$ and $a = 7 \tan 27°$.

6. **(4 points)** *In the following triangle, determine the numerical value (fully simplified) of* $\tan \theta$.

   We might label the third side (as has been done above) with a length x. By the Pythagorean theorem, $x^2 + 4^2 = 7^2$, so $x^2 = 49 - 16 = 33$ and, since lengths must be positive, $x = \sqrt{33}$. Since the tangent of an angle in a right triangle is the ratio of the opposite leg to the adjacent leg, we get $\tan \theta = \frac{4}{\sqrt{33}} = \frac{4\sqrt{33}}{33}$.