In §7.5: p. 569: #38. Find all solutions
\[ \sin 2x = 2 \tan 2x \]

**Solution:**

\[ \frac{\sin 2x - 2 \tan 2x}{\cos 2x} = 0 \]
\[ \sin 2x - 2 \frac{\sin 2x}{\cos 2x} = 0 \]
\[ \therefore \sin 2x \left(1 - \frac{2}{\cos 2x}\right) = 0 \]

\[ \because \sin 2x = 0 \quad \text{or} \quad 1 - \frac{2}{\cos 2x} = 0 \]

\[ 1 - \frac{2}{\cos 2x} = 0 \quad \therefore \frac{2}{\cos 2x} = 1 \]
\[ \cos 2x = 2 \]

There is no solution.

\[ \left\{ x \mid x = k\pi, \frac{\pi}{2} + k\pi \right\} \]
§8.1: Polar Coord. p. 582.

The Polar Coordinate System.

Conversion Formulas: (p. 584)

1. \[ \cos \theta = \frac{\text{adj}}{\text{hyp}} \]
   \[ \cos \theta = \frac{x}{r} \]
   Solving for \(x\)
   \[ x = r \cos \theta \]

2. \[ \sin \theta = \frac{\text{opp}}{\text{hyp}} = \frac{y}{r} \]
   \[ y = r \sin \theta \]

Also looking at the triangle above \(\frac{\pi}{2}\) recalling the Pythag. Thm
\[ r^2 = x^2 + y^2 \]
And
\[ \tan \theta = \frac{\text{opp}}{\text{adj}} = \frac{y}{x} \]
\[ \tan \theta = \frac{y}{x} \]

Mind your QUADRANT!
"Naming" a point in POLAR

\[ r = 2, \ \theta = \frac{\pi}{6} \]

\[ P \left( 2, \frac{\pi}{6} \right) \]

\[ (-2, \frac{7\pi}{6}) \]

\[ \frac{\pi}{6} + \pi = \frac{7\pi}{6} \]

\[ \theta = -\frac{5\pi}{6} \]

\[ (-2, -\frac{5\pi}{6}) \]

This one point can have many "names" in POLAR: \((2, \frac{\pi}{6}), (-2, \frac{7\pi}{6}), (-2, -\frac{5\pi}{6})\)
just to name a few.

\[ \boxed{C} \] Conversion of Points

1. Convert \((4, \frac{\pi}{6})_{\text{pol}}\) to rect.

   \[ x = r\cos\theta \]
   \[ y = r\sin\theta \]

   \[ r = 4, \ \theta = \frac{\pi}{6} \]

   \[ x = 4\cos\frac{\pi}{6} = 4 \cdot \frac{\sqrt{3}}{2} = 2\sqrt{3} \]
   \[ y = 4\sin\frac{\pi}{6} = 4 \cdot \frac{1}{2} = 2 \]

   \[ (4, \frac{\pi}{6})_{\text{pol}} = (2\sqrt{3}, 2)_{\text{Rec.}} \]

2. Convert \((1, -2)_{\text{rec.}}\) to polar. \(r > 0, \ 0 \leq \theta < 2\pi\)

   \[ \tan\theta = \frac{y}{x} \]
   \[ r^2 = x^2 + y^2 \]

   \[ \tan\theta = -\frac{2}{1} \]
   \[ r^2 = 5 \]
   \[ r = \pm \sqrt{5} \]
   \[ r = \sqrt{5} \]

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class ends - finish after class.

3. Note \((1, -2)\) is in Q IV.

4. \(\tan \theta = -\frac{2}{1}\) Draw triangle - Pythag. Crutch.

   The best we can do here is \(\theta = \tan^{-1}(-2)\)

5. \((1, -2)_{\text{rec}} = (\sqrt{5}, \tan^{-1}(-2))_{\text{pol.}}\)