A piston is designed as follows: One metal rod of length one is fixed to a crank at the origin, and the other end rotates in a circle of radius 1. Let the other end of this metal rod be the (variable) point \(A\). A second rod is attached at \(A\), with its other end able to slide back and forth along the positive side of the \(x\)-axis. Call this point \(B\), so that \(B\) will always have a \(y\)-coordinate of 0. A demonstration of this piston with point \(A\) colored blue and point \(B\) colored red can be found at  

https://www.desmos.com/calculator/8cqu4lcvdh

Let the distance from \(A\) to \(B = 3\), that is, the second metal rod (whose length is the distance from the blue dot to the red dot) has length 3.

Let \(\theta\) = the angle the first rod makes with the positive side of the \(x\)-axis.

1. If \(\theta = 90^\circ\), the coordinates of \(A\) are ...
2. If \(\theta = 60^\circ\), the coordinates of \(A\) are ...
3. If \(\theta = 30^\circ\), the coordinates of \(A\) are ...
4. If \(\theta = 17^\circ\), the coordinates of \(A\) are ...
5. If \(\theta = 90^\circ\), the coordinates of \(B\) are ...
6. If \(\theta = 60^\circ\), the coordinates of \(B\) are ...
7. If \(\theta = 30^\circ\), the coordinates of \(B\) are ...
8. If \(\theta = 17^\circ\), the coordinates of \(B\) are ...
9. Describe in words the step-by-step process you are using to find the coordinates of \(B\) given the angle \(\theta\).
10. For an arbitrary angle \(\theta\), the coordinates of \(A\) are ...
11. For an arbitrary angle \(\theta\), the coordinates of \(B\) are ...
12. The previous answer expresses the \(x\)-coordinate of \(B\) as a function of \(\theta\). Graph this function. Describe what the graph looks like.
13. When the length of the second rod is 10, the coordinates of \(A\) are unchanged and the coordinates of \(B\) are ...
   Also graph this function.
14. When the length of the second rod is 1, the coordinates of \(A\) are unchanged and the coordinates of \(B\) are ...
   Also graph this function. Describe what is happening physically in this setting.
15. When the length of the second rod is \(n\), the coordinates of \(A\) are unchanged and the coordinates of \(B\) are ...