Trigonometry
Activity 1b - Piston Motion

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 $\theta = 90°$, the coordinates of A are ...
2. If $\theta = 60°$, the coordinates of A are ...
3. If $\theta = 30°$, the coordinates of A are ...
4. If $\theta = 17°$, the coordinates of A are ...
5. If $\theta = 90°$, the coordinates of B are ...
6. If $\theta = 60°$, the coordinates of B are ...
7. If $\theta = 30°$, the coordinates of B are ...
8. If $\theta = 17°$, 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 θ.
10. For an arbitrary angle θ, the coordinates of A are ...
11. For an arbitrary angle θ, the coordinates of B are ...
12. The previous answer expresses the x-coordinate of B as a function of θ. 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 ...