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Animation Math Review: Self-assessment

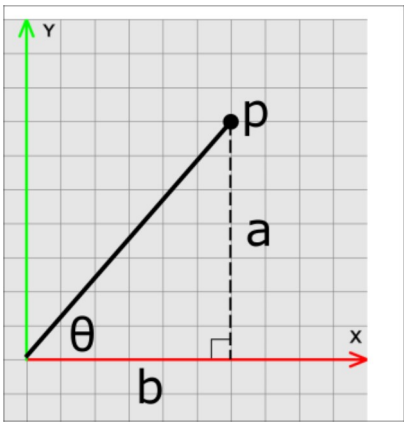
Name:

Due September 9

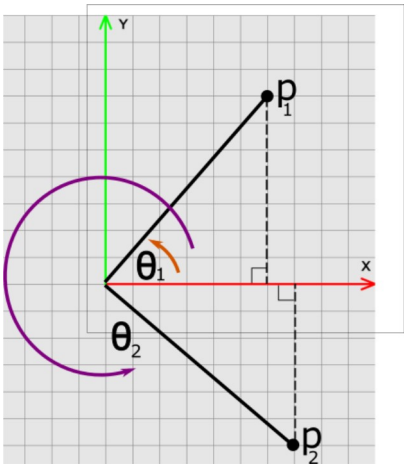
Use the questions below to identify any topics you should review. See the week 01 notes for background information on these topics.

Trigonometry

Consider the point **p** and angle θ below, where **p** is a distance of 1 unit from the origin and θ is 45 degrees. What is the coordinate of **p**? Hint: what are the values of a and b in terms of θ?



Consider the point p_1 and angle θ_1 below. Suppose $p_1 = (2, 2, 0)^T$. What is the value of θ_1? Hint: Use tangent.

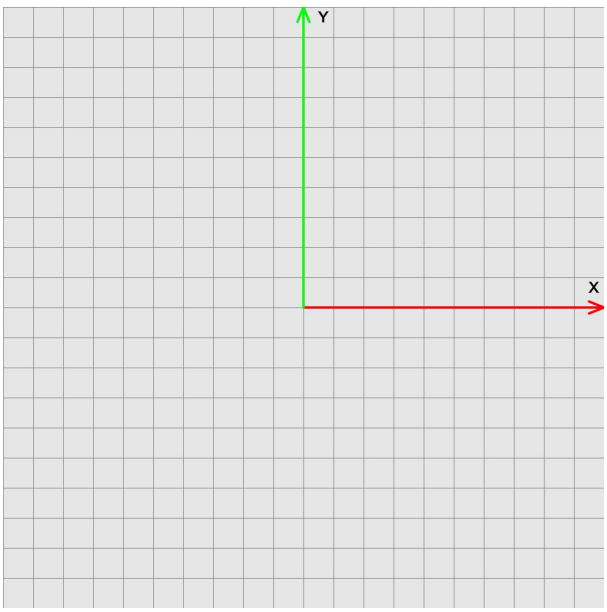


Consider the point p_2 and angle θ_2 above. Suppose $p_2 = (3, -2, 0)^T$. What is the value of θ_2? Hint: Use tangent.

Vectors

A **vector** is an n-tuple of real numbers. In this class, we will work with 2D, 3D, and 4D vectors. Suppose we have a vector **u**=(-2, 3, 0)^T and **v**=(-1, 4, 0)^T.

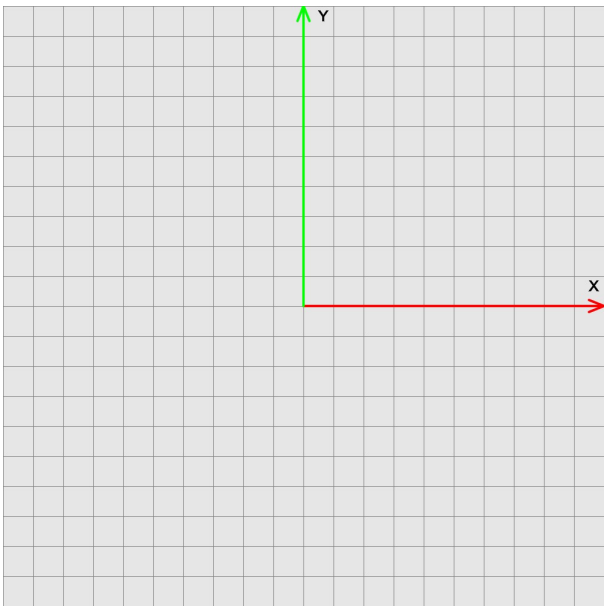
- Draw the vectors **u** and **v**, with their tails anchored at the origin below.



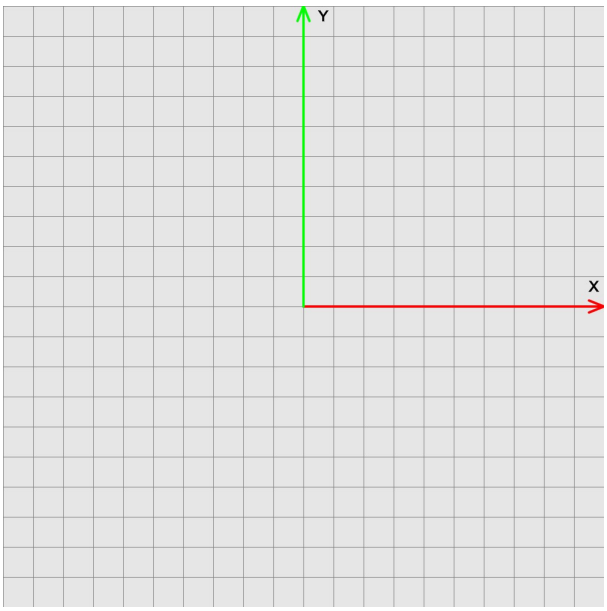
- What is the length of **u**?

- What is the distance between **u** and **v**?

- Compute and draw **u + v**.



- Compute and draw **u - v**



- Compute the cross product $u \times v$.

- Normalize the vector **u**, e.g. compute $\frac{u}{\|u\|}$.

- Compute the dot product $u \cdot v$.

Matrices

Consider the following matrices

$$A = \begin{bmatrix} 1 & 3 \\ -0.5 & 2 \end{bmatrix}, \quad B = \begin{bmatrix} -3 & 0 \\ 1 & 2 \end{bmatrix}, \quad C = \begin{bmatrix} 1 & 3 \\ -4 & 5 \\ 3 & -7 \end{bmatrix}$$

- What are the dimensions of A, B, and C?

- What is the transpose of the matric C?

- Compute the products AB and BA.

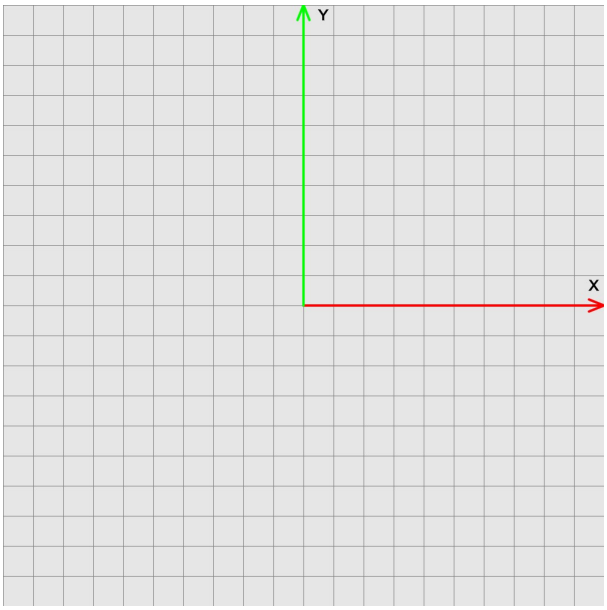
- Is it possible to multiply C times itself? Why not? What about CC^T?

- What is the product of AA^{-1}?

Consider the following matrix

$$R = \begin{bmatrix} cos(30) & sin(30) & 0 \\ -sin(30) & cos(30) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- Suppose we have a vector **u**=(1,0,0)^T. Draw **u** below. Then multiple **u** by **R** and draw **Ru**.



Polynomials

Consider the polynomial $p(t) = 9t^3 + 6t^2$.

- What is the degree of $p(t)$?

- What is the derivative of $p(t)$?

- What is the value of $p(t)$ when t = -1?

Let $B_0(t) = (t-1)^2$ and $B_1 = t - 2$.

- Compute an expression for $p(t) = B_0(t) + B_1(t)$ and re-arrange the terms into standard form

Standard form has the following pattern: $a_n t^n + \ldots + a_2 t^2 + at + a_0$.

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