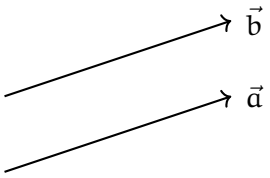
CHAPTER 1

Parallel and Perpendicular

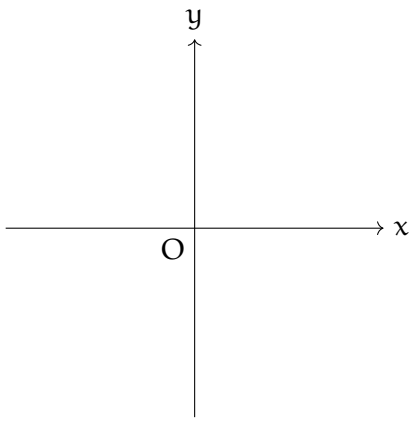
A vector is a line or ray with defined length (referred to as magnitude) and direction (given in degrees or radians). Velocity, force, and displacement are all examples of quantities that can be represented as vectors. Vectors are commonly drawn as arrows, where the length of the arrow corresponds to the magnitude and the direction of the arrow shows the direction of the vector.

Understanding how vectors relate to each other—such as being parallel or perpendicular—is fundamental in mathematics and physics. Two vectors are said to be parallel if they have the same or opposite direction. In simpler terms, if two vectors are pointing in the same direction (even if their magnitudes differ), they are considered parallel. For example, imagine you have a vector representing the direction and speed of a car moving north. If you have another vector representing the direction and speed of a different car also moving north, these vectors are parallel. We have already seen parallel lines when talking about parallel circuits, meaning they offer multiple paths of flow but don't intersect.



On the other hand, if two vectors point are in completely opposite directions, they are still considered parallel. For example, if one vector represents a car moving north and the other represents a car moving south, these vectors are parallel, but in opposite directions.

Perpendicular vectors, as the name suggests, are vectors that intersect each other at a right angle, forming a 90-degree angle. If we imagine a sheet of paper, drawing a horizontal vector and a vertical vector on that paper would create perpendicular vectors. In this case, the horizontal vector represents left-right direction, while the vertical vector represents up-down direction. Perpendicular vectors are often seen in geometric shapes, such as squares and rectangles, where their sides intersect at right angles. The coordinate planes are also perpendicular.



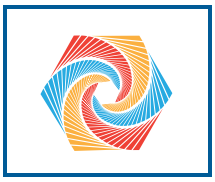
A fundamental property of perpendicular vectors is that their dot product is zero. The dot product is a mathematical operation that measures the extent to which two vectors align with each other. When two vectors are perpendicular, their dot product is always zero. This property provides a useful tool for determining whether two given vectors are perpendicular.

Understanding parallel and perpendicular vectors is essential in various areas of mathematics and physics. For example, in geometry, knowledge of perpendicular vectors helps us determine whether lines are perpendicular or parallel. In physics, vectors can represent forces, velocities, or displacements, and identifying parallel or perpendicular vectors aids in analyzing motion and forces acting on objects.

In summary, parallel vectors have the same or opposite direction, while perpendicular vectors intersect at a right angle. Recognizing these relationships between vectors enables us to solve problems involving geometry, physics, and many other fields. As you delve deeper into the exciting world of vectors, keep an eye out for parallel and perpendicular relationships, as they often hold valuable insights and solutions. We are going to get into graphing these two lines and their equations in the next chapter!

Appendix A

Answers to Exercises



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