Vetores

Physics for Scientists and Engineers, R. A. Serway and J. W. Jewett, Cengage

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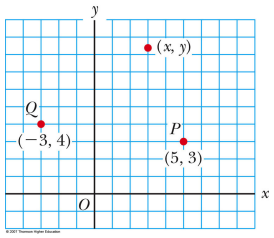
Cartesian Coordinate System

- Also called rectangular coordinate system
- *x*- and *y*- axes intersect at the origin
- Points are labeled (*x*,*y*)



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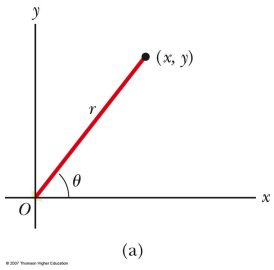
Polar Coordinate System

- Origin and reference line are noted
- Point is distance *r* from the origin in the direction of angle θ, ccw from reference line
- Points are labeled (r,θ)



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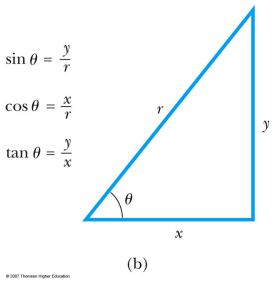
Polar to Cartesian Coordinates

- Based on forming a right triangle from *r* and θ
- $x = r \cos \theta$
- $y = r \sin \theta$



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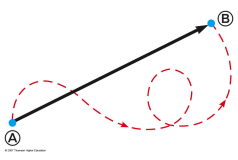
Vectors and Scalars

- A ***scalar quantity*** is completely specified by a single value with an appropriate unit and has no direction.
- A ***vector quantity*** is completely described by a number and appropriate units plus a direction.

- A particle travels from A to B along the path shown by the dotted red line
  - This is the ***distance*** traveled and is a scalar
- The ***displacement*** is the solid line from A to B
  - The displacement is independent of the path taken between the two points
  - Displacement is a vector



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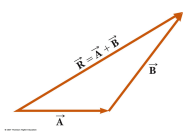
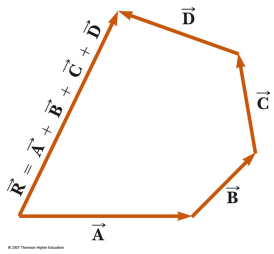
Adding Vectors Graphically

- Draw the vectors "tip-to-tail"





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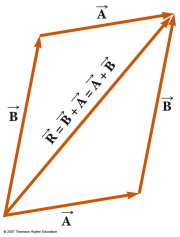
Adding Vectors, Rules

- When two vectors are added, the sum is independent of the order of the addition.
  - This is the ***Commutative Law of Addition***



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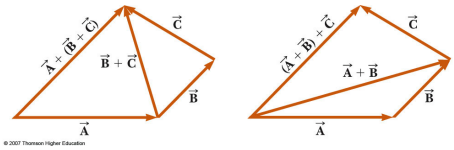
Adding Vectors, Rules cont.

- When adding three or more vectors, their sum is independent of the way in which the individual vectors are grouped
  - This is called the ***Associative Property of Addition***



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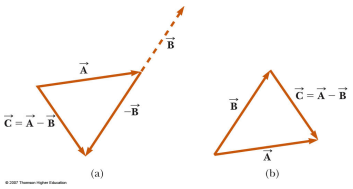
Subtracting Vectors

- Special case of vector addition



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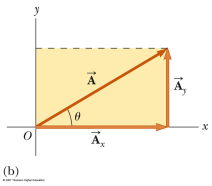
Components of a Vector

The x-component of a vector is the projection along the x-axis

$$A_x = A \cos\theta$$

The y-component of a vector is the projection along the y-axis

$$A_y = A \sin\theta$$



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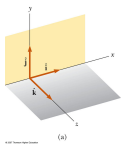
Unit Vectors

- A ***unit vector*** is a dimensionless vector with a magnitude of exactly 1.
- Unit vectors are used to specify a direction and have no other physical significance

- They form a set of mutually perpendicular vectors in a right-handed coordinate system



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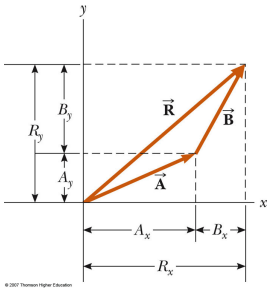
Adding Vectors with Unit Vectors

- Note the relationships among the components of the resultant and the components of the original vectors
- $R_x = A_x + B_x$
- $R_y = A_y + B_y$



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