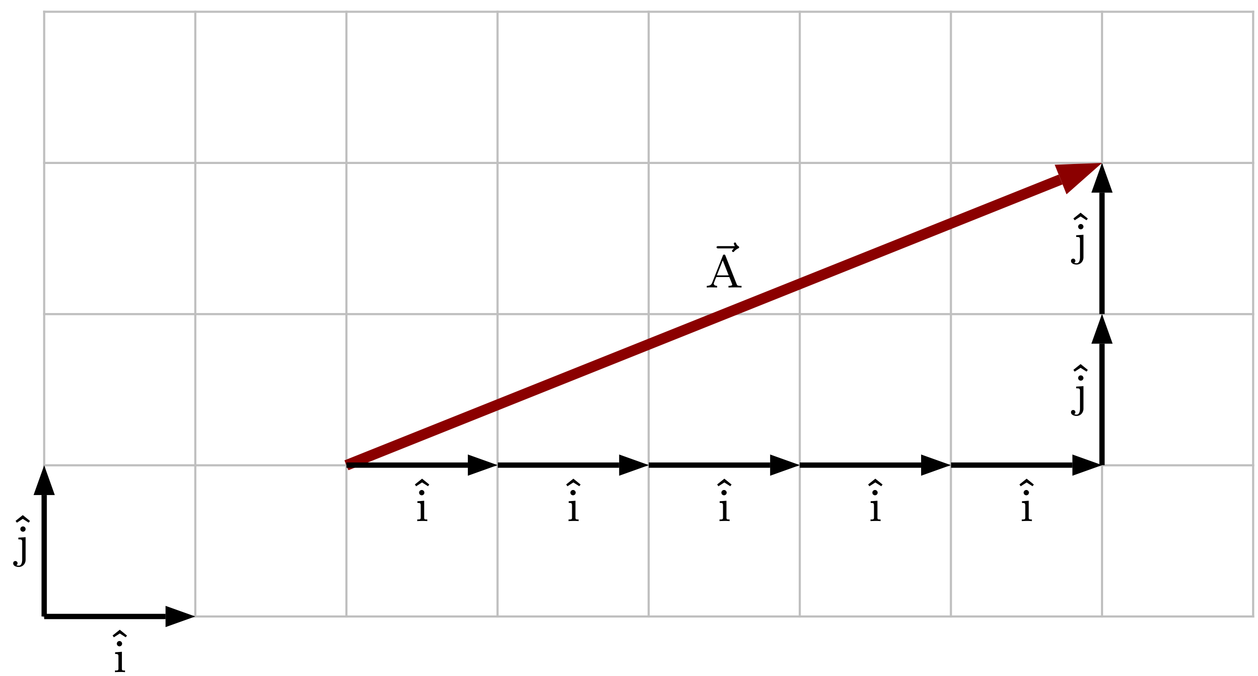
Constructing a Vector from Unit Vectors

How the illustrated vector $\vec{\mathrm{A}}$ is decomposed into unit vectors

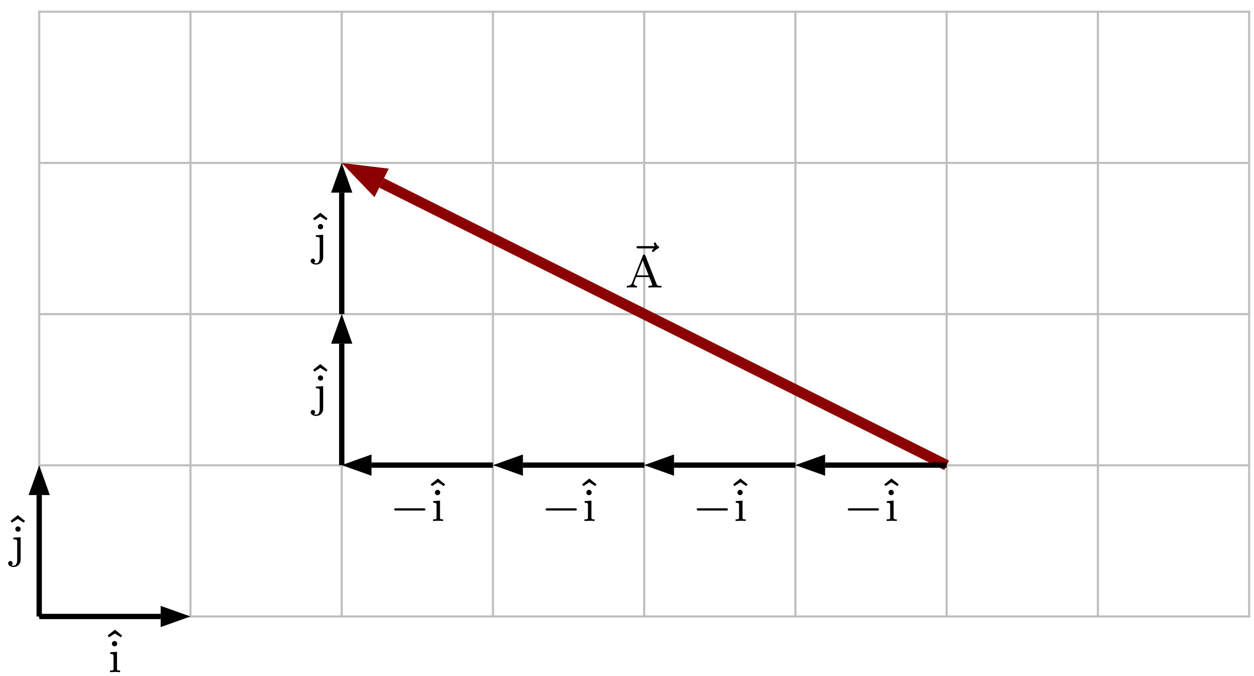
$$\vec{\mathrm{A}} = 5\hat{\mathrm{i}} + 2\hat{\mathrm{j}}$$



Constructing a Vector from Unit Vectors

How the illustrated vector $\vec{\mathrm{A}}$ is decomposed into unit vectors

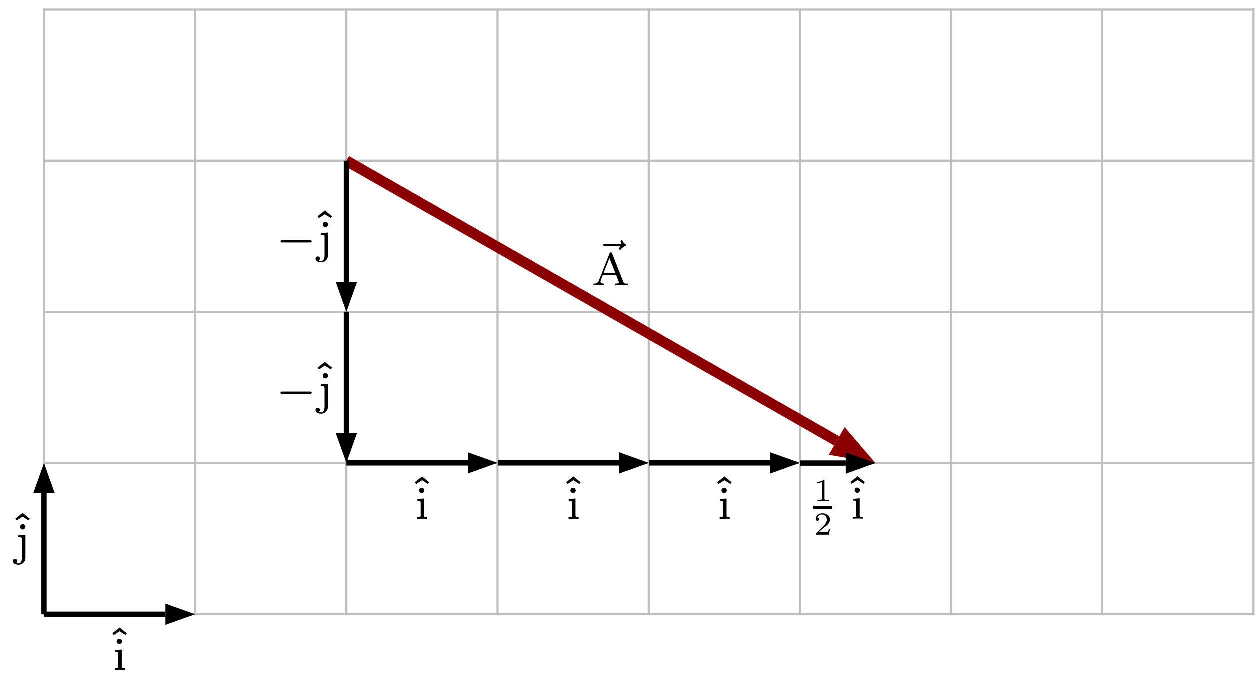
$$\vec{\mathrm{A}} = -4\hat{\imath} + 2\hat{\jmath}$$



Constructing a Vector from Unit Vectors

How the illustrated vector $\vec{\mathrm{A}}$ is decomposed into unit vectors

$$\vec{\mathrm{A}} = 3.5\hat{\mathrm{i}} - 2\hat{\mathrm{j}}$$



Warm Up Question 1

Let $\vec{\mathrm{A}} = 2\hat{\mathrm{i}} + 3\hat{\mathrm{j}}$ and suppose that $\vec{\mathrm{B}} = \alpha\vec{\mathrm{A}}$ for some real number α. Explain whether it is possible that

$$\vec{\mathrm{B}} = 20\hat{\mathrm{i}} - 30\hat{\mathrm{j}}.$$

1. Yes. Use $\alpha = 10$.
2. Yes. Use $\alpha = -10$.
3. No. The direction of $\vec{\mathrm{B}}$ is neither the direction of $\vec{\mathrm{A}}$ nor exactly the opposite of $\vec{\mathrm{A}}$.
4. No. If α were positive both the $\hat{i}$ and $\hat{j}$ components of $\vec{\mathrm{B}}$ would be positive. If it were negative they would both be negative.
5. No. It requires multiplication by both positive and negative.

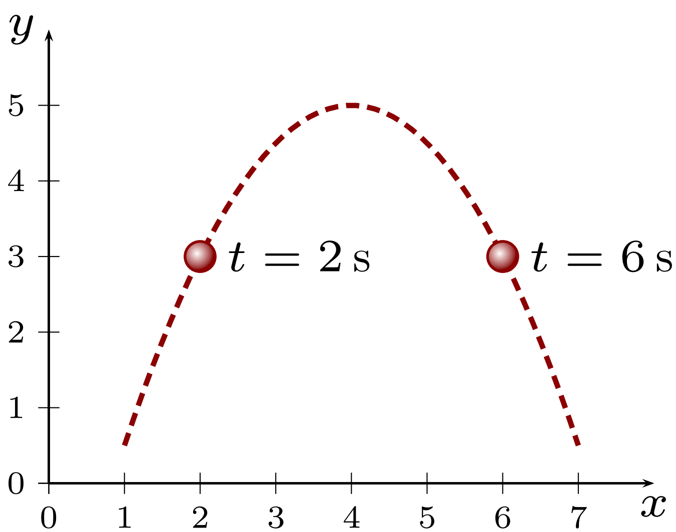
Warm Up Question 2

A rhinoceros beetle walks along a sheet a graph paper in a straight line starting at the point (5,5) and ending at the point (5,0). Describe the direction of its average velocity vector for this motion. Explain your answer.

1. Negative y. The displacement is $\Delta\vec{\mathrm{r}} = -5\hat{\mathrm{j}}$
2. Left. Approaches the origin.

Question 1

A ball follows the indicated trajectory. Its positions (units are meters) at two instants are indicated.

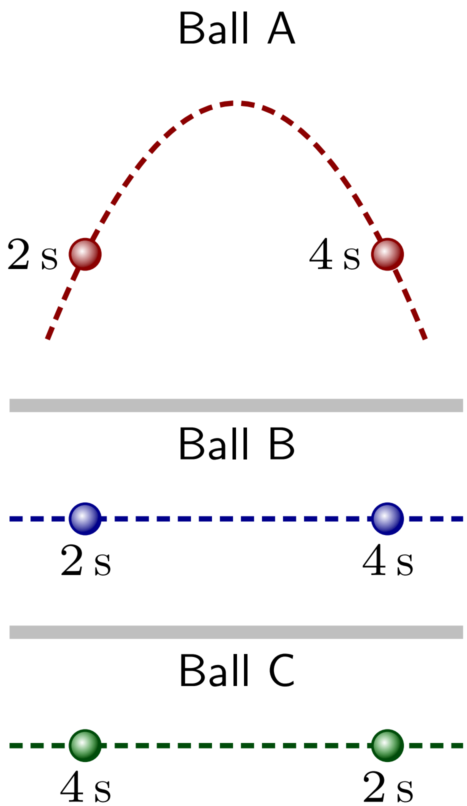


Which of the following best represents its average velocity between the two instants?

1. $\vec{\mathrm{v}}_{\mathrm{avg}} = 1\,\mathrm{m/s}$
2. $\vec{\mathrm{v}}_{\mathrm{avg}} = 1\,\mathrm{m/s}$ in direction $\rightarrow$
3. $\vec{\mathrm{v}}_{\mathrm{avg}} = 1\,\mathrm{m/s}$ in direction $\downarrow$
4. $\vec{\mathrm{v}}_{\mathrm{avg}} = 1\,\mathrm{m/s}$ in direction $\searrow$
5. $\vec{\mathrm{v}}_{\mathrm{avg}} = 1.5\,\mathrm{m/s}$ in direction $\nearrow$
6. $\vec{\mathrm{v}}_{\mathrm{avg}}$ has magnitude larger than $1.5\,\mathrm{m/s}$.

Question 2

Various balls follow the illustrated trajectories.

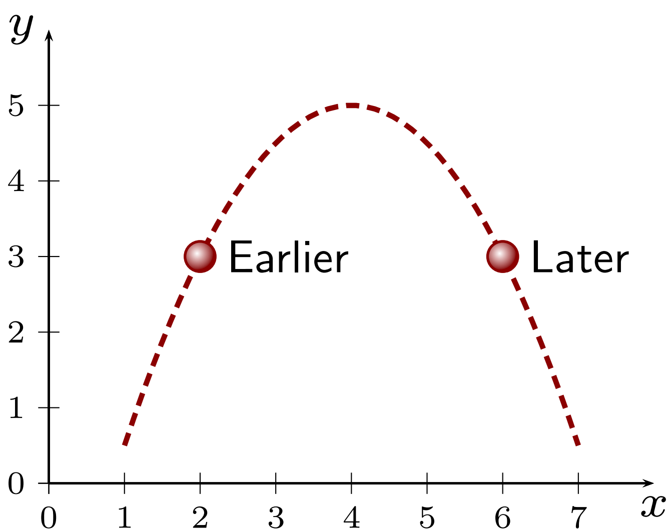


Which balls have the same average velocity in the interval from $2\,\mathrm{s}$ to $4\,\mathrm{s}$?

1. All have the same.
2. None have the same.
3. A and B.
4. B and C.
5. A and C.

Question 3

A projectile follows the indicated trajectory. Its positions (units are meters) at two instants are indicated.



Which of the following is true about the components of the velocity, $\vec{v}_0$, at the indicated earlier moment?

1. $v_{0x} > 0$ and $v_{0y} > 0$
2. $v_{0x} > 0$ and $v_{0y} < 0$
3. $v_{0x} < 0$ and $v_{0y} > 0$
4. $v_{0x} < 0$ and $v_{0y} < 0$
5. At least one of v_{0x} and v_{0y} is zero.