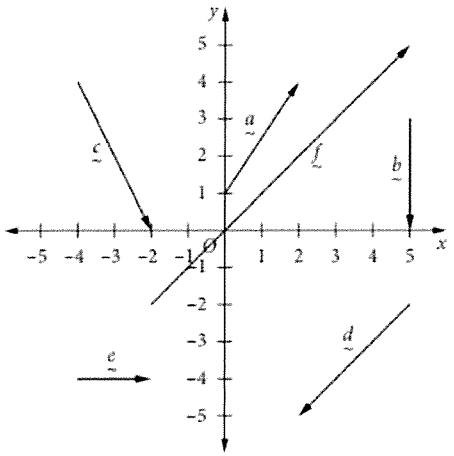
VECTORS IN COMPONENT FORM

1 Express each vector shown in component form.

(a) $\underset{\sim}{a}$ (b) $\underset{\sim}{b}$ (c) $\underset{\sim}{c}$

(d) $\underset{\sim}{d}$ (e) $\underset{\sim}{e}$ (f) $\underset{\sim}{f}$



2 Find the magnitude of the following vectors.

(a) $\underset{\sim}{a} = 5\underset{\sim}{i} + 4\underset{\sim}{j}$ (b) $-4\underset{\sim}{i} + 7\underset{\sim}{j}$ (c) $7\underset{\sim}{i} - 24\underset{\sim}{j}$ (d) $-5\underset{\sim}{i}$

3 Resolve the following vectors into component form $x\underset{\sim}{i} + y\underset{\sim}{j}$, correct to two decimal places.

(a) $\underset{\sim}{a}$ has a magnitude of 15 units and has a direction of 35° to the positive x-axis.

(b) $\underset{\sim}{b}$ has a magnitude of 23 units and has a direction of 121° to the positive x-axis.

4 Given $\underset{\sim}{a} = 4\underset{\sim}{i} - 5\underset{\sim}{j}$ and $\underset{\sim}{b} = 3\underset{\sim}{i} + 2\underset{\sim}{j}$, find: (a) $\underset{\sim}{a} + \underset{\sim}{b}$ (b) $\underset{\sim}{b} - \underset{\sim}{a}$ (c) $2\underset{\sim}{a} + 7\underset{\sim}{b}$

6 Find the values of the unknown pronumerals in the following equations.

(a) $5\underset{\sim}{i} - 4\underset{\sim}{j} = 3a\underset{\sim}{i} + 2b\underset{\sim}{j}$ (b) $(x + 2y)\underset{\sim}{i} + y\underset{\sim}{j} = -3\underset{\sim}{i} + 7\underset{\sim}{j}$

(e) $\left(x^2 + 5x\right)\underset{\sim}{i} + \left(y^3 - 1\right)\underset{\sim}{j} = -6\underset{\sim}{i} + 7\underset{\sim}{j}$

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10 Given $\underset{\sim}{a} = -13\underset{\sim}{i} + 20\underset{\sim}{j}$ and $\underset{\sim}{b} = 2\underset{\sim}{i} + 15\underset{\sim}{j}$, find:

(a) $|\underset{\sim}{a} - \underset{\sim}{b}|$ **(b)** the value of x so that the vector $x\underset{\sim}{a} + 4\underset{\sim}{b}$ is parallel to the x-axis.

12 Which one of the following vectors is parallel to the vector $\underset{\sim}{f} = 14\underset{\sim}{i} - 6\underset{\sim}{j}$?

A $\underset{\sim}{a} = 28\underset{\sim}{i} + 12\underset{\sim}{j}$ **B** $\underset{\sim}{b} = 14\underset{\sim}{i} + 6\underset{\sim}{j}$ **C** $\underset{\sim}{c} = -14\underset{\sim}{i} - 6\underset{\sim}{j}$ **D** $\underset{\sim}{d} = -28\underset{\sim}{i} + 12\underset{\sim}{j}$

16 For $\underset{\sim}{b} = 3\underset{\sim}{i} - 9\underset{\sim}{j}$:

(a) find $\hat{\underset{\sim}{b}}$ **(b)** find vector $\underset{\sim}{c}$ in the direction of $\underset{\sim}{b}$ with a magnitude of 15.

19 What is the unit vector in the direction of $\underset{\sim}{a} = -2\underset{\sim}{i} + 5\underset{\sim}{j}$ is?

A $\frac{1}{7}(-2\underset{\sim}{i} + 5\underset{\sim}{i})$ **B** $\frac{1}{29}(-2\underset{\sim}{i} + 5\underset{\sim}{j})$ **C** $\frac{1}{\sqrt{29}}(-2\underset{\sim}{i} + 5\underset{\sim}{j})$ **D** $\frac{1}{\sqrt{21}}(-2\underset{\sim}{i} + 5\underset{\sim}{j})$

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23 ΔOAB is a triangle in which $\overrightarrow{OA} = 6\underset{\sim}{i}$ and $\overrightarrow{OB} = 4\underset{\sim}{j}$. The point M with position vector $\overrightarrow{OM} = x\underset{\sim}{i} + y\underset{\sim}{j}$ is equidistant from O, A and B.

(a) Find the values of x and y.

(b) Find the vectors $\overrightarrow{AM}$, $\overrightarrow{MB}$ and $\overrightarrow{OM}$.

(c) Find the values of $\left|\overrightarrow{AM}\right|$, $\left|\overrightarrow{MB}\right|$ and $\left|\overrightarrow{OM}\right|$.

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24 $OABC$ is a parallelogram in which vectors $\overrightarrow{OA} = 2\underset{\sim}{i} - 4\underset{\sim}{j}$ and $\overrightarrow{OC} = 3\underset{\sim}{i} + 2\underset{\sim}{j}$.

(a) Find vectors $\overrightarrow{AB}$ and $\overrightarrow{CB}$.

(b) Find the vectors $\overrightarrow{OB}$ and $\overrightarrow{AC}$, the diagonals of the parallelogram.

(c) Find the vectors $\overrightarrow{OP}$ and $\overrightarrow{OQ}$, where P is the midpoint of $\overline{OB}$ and Q is the midpoint of $\overline{AC}$. What can you say about the points P and Q?

(d) Find the vectors $\overrightarrow{OR}$ and $\overrightarrow{CR}$, where R is the midpoint of $\overline{AB}$.

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25 $OABC$ is a square in which vectors $\overrightarrow{OA} = 3\underset{\sim}{i} - 2\underset{\sim}{j}$ and $\overrightarrow{OC} = 2\underset{\sim}{i} + 3\underset{\sim}{j}$. M is the midpoint of $\overline{AB}$ and N divides $\overline{CB}$ internally in the ratio 1 : 2.

(a) Find the vectors $\overrightarrow{OB}$, $\overrightarrow{AC}$, $\overrightarrow{OM}$, $\overrightarrow{ON}$ and $\overrightarrow{NB}$. **(b)** Find the length of the diagonals, $\left|\overrightarrow{OB}\right|$ and $\left|\overrightarrow{AC}\right|$.

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27 **(a)** If $\underset{\sim}{a} = 3p\underset{\sim}{i} + 4p\underset{\sim}{j}$, $p > 0$ and $|\underset{\sim}{a}| = 2$, find the exact value of p. **(b)** Hence find $\hat{\underset{\sim}{a}}$.

(c) Find the vector $\underset{\sim}{b}$ which is parallel to $\hat{\underset{\sim}{a}}$, if $|\underset{\sim}{b}| = 10$.

(d) If $\underset{\sim}{c} = 7q\underset{\sim}{i} + 24q\underset{\sim}{j}$, $q > 0$, and $|\underset{\sim}{c}| = 4$, find the exact value of q. **(e)** Hence find $\hat{\underset{\sim}{c}}$.

(f) Find the vector $\underset{\sim}{d}$ in the direction of $\hat{\underset{\sim}{c}}$ where $|\underset{\sim}{d}| = 50$.

(g) Find the vector with magnitude 10 that is parallel to the vector $\underset{\sim}{b} + \underset{\sim}{d}$.