



SL 1

Name \_\_\_\_\_

Algebraic Operations with Vectors: WS #6 12F (335) #1,2,6,9,11,14,15,16

Two useful rules are:

- if  $x + a = b$  then  $x = b - a$
- if  $kx = a$  then  $x = \frac{1}{k}a$  ( $k \neq 0$ )

Solve for x:

- a  $3x - r = s$
- b  $c - 2x = d$

a  $3x - r = s$

$\therefore 3x = s + r$

$\therefore x = \frac{1}{3}(s + r)$

b  $c - 2x = d$

$\therefore c - d = 2x$

$\therefore \frac{1}{2}(c - d) = x$

**EXERCISE 12F**

1 Solve the following vector equations for x:

a  $2x = q$

b  $\frac{1}{2}x = n$

c  $-3x = p$

d  $q + 2x = r$

e  $4s - 5x = t$

f  $4m - \frac{1}{3}x = n$

2 Suppose  $r = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$  and  $s = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ . Find y if:

a  $2y = r$

b  $\frac{1}{2}y = s$

c  $r + 2y = s$

d  $3s - 4y = r$

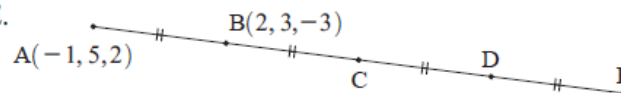
6 Suppose  $a = \begin{pmatrix} -1 \\ 2 \\ 3 \end{pmatrix}$  and  $b = \begin{pmatrix} 2 \\ -2 \\ 1 \end{pmatrix}$ . Find x if:

a  $2a + x = b$

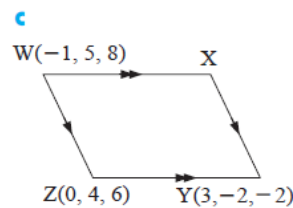
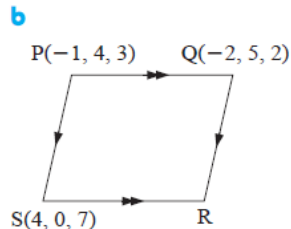
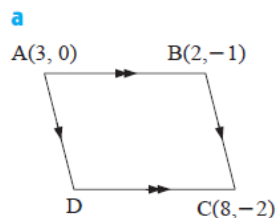
b  $3x - a = 2b$

c  $2b - 2x = -a$

9 Find the coordinates of C, D and E.



11 Use vector methods to find the remaining vertex of:



14 For  $\mathbf{a} = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix}$ ,  $\mathbf{b} = \begin{pmatrix} 1 \\ 2 \\ -3 \end{pmatrix}$  and  $\mathbf{c} = \begin{pmatrix} 0 \\ 1 \\ -3 \end{pmatrix}$ , find:

**a**  $\mathbf{a} + \mathbf{b}$

**b**  $\mathbf{a} - \mathbf{b}$

**c**  $\mathbf{b} + 2\mathbf{c}$

**d**  $\mathbf{a} - 3\mathbf{c}$

**e**  $\mathbf{a} + \mathbf{b} + \mathbf{c}$

**f**  $\mathbf{c} - \frac{1}{2}\mathbf{a}$

**g**  $\mathbf{a} - \mathbf{b} - \mathbf{c}$

**h**  $2\mathbf{b} - \mathbf{c} + \mathbf{a}$

15 If  $\mathbf{a} = \begin{pmatrix} -1 \\ 1 \\ 3 \end{pmatrix}$ ,  $\mathbf{b} = \begin{pmatrix} 1 \\ -3 \\ 2 \end{pmatrix}$  and  $\mathbf{c} = \begin{pmatrix} -2 \\ 2 \\ 4 \end{pmatrix}$  find:

**a**  $|\mathbf{a}|$

**b**  $|\mathbf{b}|$

**c**  $|\mathbf{b} + \mathbf{c}|$

**d**  $|\mathbf{a} - \mathbf{c}|$

**e**  $|\mathbf{a}| |\mathbf{b}|$

**f**  $\frac{1}{|\mathbf{a}|} \mathbf{a}$

16 Find scalars  $r$  and  $s$  such that:

**a**  $r \begin{pmatrix} 1 \\ -1 \end{pmatrix} + s \begin{pmatrix} 2 \\ 5 \end{pmatrix} = \begin{pmatrix} -8 \\ -27 \end{pmatrix}$

**b**  $r \begin{pmatrix} 2 \\ -3 \\ 1 \end{pmatrix} + s \begin{pmatrix} 1 \\ 7 \\ 2 \end{pmatrix} = \begin{pmatrix} 7 \\ -19 \\ 2 \end{pmatrix}$

### EXERCISE 12F

1 **a**  $x = \frac{1}{2}q$

**b**  $x = 2n$

**c**  $x = -\frac{1}{3}p$

**d**  $x = \frac{1}{2}(r - q)$

**e**  $x = \frac{1}{5}(4s - t)$

**f**  $x = 3(4m - n)$

2 **a**  $y = \begin{pmatrix} -1 \\ \frac{3}{2} \end{pmatrix}$

**b**  $y = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$

**c**  $y = \begin{pmatrix} \frac{3}{2} \\ -\frac{1}{2} \end{pmatrix}$

**d**  $y = \begin{pmatrix} \frac{5}{4} \\ \frac{3}{4} \end{pmatrix}$

6 **a**  $x = \begin{pmatrix} 4 \\ -6 \\ -5 \end{pmatrix}$

**b**  $x = \begin{pmatrix} 1 \\ -\frac{2}{3} \\ \frac{5}{3} \end{pmatrix}$

**c**  $x = \begin{pmatrix} \frac{3}{2} \\ -1 \\ \frac{5}{2} \end{pmatrix}$

9 C(5, 1, -8), D(8, -1, -13), E(11, -3, -18)

11 **a** D(9, -1)

**b** R(3, 1, 6)

**c** X(2, -1, 0)

14 **a**  $\begin{pmatrix} 3 \\ 1 \\ -2 \end{pmatrix}$

**b**  $\begin{pmatrix} 1 \\ -3 \\ 4 \end{pmatrix}$

**c**  $\begin{pmatrix} 1 \\ 4 \\ -9 \end{pmatrix}$

**d**  $\begin{pmatrix} 2 \\ -4 \\ 10 \end{pmatrix}$

**e**  $\begin{pmatrix} 3 \\ 2 \\ -5 \end{pmatrix}$

**f**  $\begin{pmatrix} -1 \\ \frac{3}{2} \\ -\frac{7}{2} \end{pmatrix}$

**g**  $\begin{pmatrix} 1 \\ -4 \\ 7 \end{pmatrix}$

**h**  $\begin{pmatrix} 4 \\ 2 \\ -2 \end{pmatrix}$

15 **a**  $\sqrt{11}$  units

**b**  $\sqrt{14}$  units

**c**  $\sqrt{38}$  units

**d**  $\sqrt{3}$  units

**e**  $\begin{pmatrix} \sqrt{11} \\ -3\sqrt{11} \\ 2\sqrt{11} \end{pmatrix}$

**f**  $\begin{pmatrix} -\frac{1}{\sqrt{11}} \\ \frac{1}{\sqrt{11}} \\ \frac{3}{\sqrt{11}} \end{pmatrix}$

16 **a**  $r = 2, s = -5$

**b**  $r = 4, s = -1$