SAT PREP **Name** ______________________________

Assignment : Vector and Vector Equation of line **Date** __________________

1. A line L passes through A(1, –1, 2) and is parallel to the line $\boldsymbol{r} = \begin{pmatrix} -2 \\ 1 \\ 5 \end{pmatrix} + s\begin{pmatrix} 1 \\ 3 \\ -2 \end{pmatrix}$. Write down a vector equation for L in the form $\boldsymbol{r} = \boldsymbol{a} + t\boldsymbol{b}$.

2. Line L_1 passes through points A(1, –1, 4) and B(2, –2, 5).

(a) Find $\overrightarrow{\mathrm{AB}}$.

(b) Find an equation for L_1 in the form $\boldsymbol{r} = \boldsymbol{a} + \mathrm{t}\boldsymbol{b}$.

Line L_2 has equation $\boldsymbol{r} = \begin{pmatrix} 2 \\ 4 \\ 7 \end{pmatrix} + s\begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix}$.

(c) Find the angle between L_1 and L_2.

(d) The lines L_1 and L_2 intersect at point C. Find the coordinates of C.

3. Let $\overrightarrow{\mathrm{AB}} = \begin{pmatrix} 6 \\ -2 \\ 3 \end{pmatrix}$ and $\overrightarrow{\mathrm{AC}} = \begin{pmatrix} -2 \\ -3 \\ 2 \end{pmatrix}$.

(a) Find $\overrightarrow{\mathrm{BC}}$.

(b) Find a unit vector in the direction of $\overrightarrow{\mathrm{AB}}$.

4. Find the cosine of the angle between the two vectors $3\boldsymbol{i} + 4\boldsymbol{j} + 5\boldsymbol{k}$ and $4\boldsymbol{i} - 5\boldsymbol{j} - 3\boldsymbol{k}$.

5. Two lines with equations $\boldsymbol{r}_1 = \begin{pmatrix} 2 \\ 3 \\ -1 \end{pmatrix} + s\begin{pmatrix} 5 \\ -3 \\ 2 \end{pmatrix}$ and $\boldsymbol{r}_2 = \begin{pmatrix} 9 \\ 2 \\ 2 \end{pmatrix} + t\begin{pmatrix} -3 \\ 5 \\ -1 \end{pmatrix}$ intersect at the point P. Find the coordinates of P.

6. The line L_1 is represented by $\boldsymbol{r}_1 = \begin{pmatrix} 2 \\ 5 \\ 3 \end{pmatrix} + s\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$ and the line L_2 by $\boldsymbol{r}_2 = \begin{pmatrix} 3 \\ -3 \\ 8 \end{pmatrix} + t\begin{pmatrix} -1 \\ 3 \\ -4 \end{pmatrix}$.

The lines L_1 and L_2 intersect at point T. Find the coordinates of T.

7. A triangle has its vertices at A(–1, 3), B(3, 6) and C(–4, 4).

(a) Show that $\overrightarrow{\mathrm{AB}} \bullet \overrightarrow{\mathrm{AC}} = -9$.

(b) Find $\mathrm{B\hat{A}C}$.

8. The line L passes through the points A (3, 2, 1) and B (1, 5, 3).

(a) Find the vector $\overrightarrow{\mathrm{AB}}$.

(b) Write down a vector equation of the line L in the form $\boldsymbol{r} = \boldsymbol{a} + t\boldsymbol{b}$.

Answer to Assignment Vector and Vector Equation of line

1. $\boldsymbol{r} = \begin{pmatrix} 1 \\ -1 \\ 2 \end{pmatrix} + t\begin{pmatrix} 1 \\ 3 \\ -2 \end{pmatrix}$

2. (a) $\overrightarrow{\text{AB}} = \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix}$

(b) $\boldsymbol{r} = \begin{pmatrix} 1 \\ -1 \\ 4 \end{pmatrix} + t\begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix}, \boldsymbol{r} = \begin{pmatrix} 2+t \\ -2-t \\ 5+t \end{pmatrix}, \boldsymbol{r} = 2\boldsymbol{i} - 2\boldsymbol{j} + 5\boldsymbol{k} + t(\boldsymbol{i} - \boldsymbol{j} + \boldsymbol{k})$

(c) $\theta = 0.906$ (51.9°)

(d) C is (–2, 2, 1)

3. (a) $\overrightarrow{\text{BC}} = \begin{pmatrix} -8 \\ -1 \\ -1 \end{pmatrix}$

(b) unit vector is $\frac{1}{7}\begin{pmatrix} 6 \\ -2 \\ 3 \end{pmatrix}$ $\left(= \begin{pmatrix} \frac{6}{7} \\ -\frac{2}{7} \\ \frac{3}{7} \end{pmatrix} \right)$

4. $-\frac{23}{50}$ (= –0.46)

5. P is (12, –3, 3) $\left(\text{accept} \begin{pmatrix} 12 \\ -3 \\ 3 \end{pmatrix} \right)$

6. (1, 3, 0)

7. (a) –9

(b) $\text{B}\hat{\text{A}}\text{C} = 2.47$ (radians), 125°

8. (a) $\overrightarrow{\text{AB}} = \begin{pmatrix} -2 \\ 3 \\ 2 \end{pmatrix}$

(b) Using $\boldsymbol{r} = \boldsymbol{a} + t\boldsymbol{b}$

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix} + t\begin{pmatrix} -2 \\ 3 \\ 2 \end{pmatrix} \text{ or } \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ 5 \\ 3 \end{pmatrix} + t\begin{pmatrix} -2 \\ 3 \\ 2 \end{pmatrix}$$