

## Geometry practice problems

1.

We have vectors  $\underline{a} = (1, -1)$ ,  $\underline{b} = (2, 5)$  and  $\underline{c} = (3, 6)$ . Determine:

a.  $\underline{d} = 3\underline{a} + 4\underline{b} - \underline{c}$

b.  $|\underline{d}|$ .

**Solutions:**

a.  $\underline{d} = (8, 11)$

b.  $|\underline{d}| = 13, 36$ .

2.

Given  $\underline{v}_1 = (2, 3)$  and  $\underline{v}_2 = (3, -2)$ , decompose  $\underline{a} = (7, 4)$  into components  $\underline{a}_1$  and  $\underline{a}_2$ , such that  $\underline{a}_1 \parallel \underline{v}_1$  and  $\underline{a}_2 \parallel \underline{v}_2$  holds.

**Solution:**  $\underline{a}_1 = (4, 6)$  and  $\underline{a}_2 = (3, -2)$ .

3.

Determine the value of  $\alpha$  such that  $\underline{a} = (5, 8)$  and  $\underline{b} = (4, \alpha)$  are perpendicular to each other!

**Solution:**  $\alpha = -2, 5$ .

4.

We have  $\underline{a} = (-3, -4, 0)$  and  $\underline{b} = (5, 3, 0)$ . Determine:

a.  $\underline{a} \cdot \underline{b}$

b.  $|\underline{a} \times \underline{b}|$ ,

c. The angle  $\underline{a}$  and  $\underline{b}$  span.

**Solutions:**

a.  $-27$

b.  $11$

c.  $158^\circ$ .

**5.**

The vertices of the  $ABC$  triangle are given as  $\underline{A} = (2, 4)$ ,  $\underline{B} = (8, 3)$  and  $\underline{C} = (5, 7)$ . Determine:

- a. The angle at vertex  $B$
- b. The area of the triangle.

**Solutions:**

- a.  $43, 6^\circ$
- b. 10, 5.

**6.**

We know three vertices of the  $ABCD$  parallelogram:  $\underline{A} = (0, 0)$ ,  $\underline{B} = (4, 3)$  and  $\underline{C} = (7, 5)$ . Determine:

- a.  $\underline{D}$
- b. the length of the diagonals,
- c. the area of the parallelogram.

**Solutions:**

- a.  $\underline{D} = (3, 2)$
- b. 8, 6 and 1, 41
- c. 1.