

Individual Tasks to Chapter 2

Task 1. Find decomposition of the vector \vec{x} in the basis of vectors \vec{p} , \vec{q} , \vec{r} .

1.1. $\vec{x} = \{-2, 4, 7\}$, $\vec{p} = \{0, 1, 2\}$, $\vec{q} = \{1, 0, 1\}$, $\vec{r} = \{-1, 2, 4\}$.

1.2. $\vec{x} = \{6, 12, -1\}$, $\vec{p} = \{1, 3, 0\}$, $\vec{q} = \{2, -1, 1\}$, $\vec{r} = \{0, -1, 2\}$.

1.3. $\vec{x} = \{1, -4, 4\}$, $\vec{p} = \{2, 1, -1\}$, $\vec{q} = \{0, 3, 2\}$, $\vec{r} = \{1, -1, 1\}$.

1.4. $\vec{x} = \{-9, 5, 5\}$, $\vec{p} = \{4, 1, 1\}$, $\vec{q} = \{2, 0, -3\}$, $\vec{r} = \{-1, 2, 1\}$.

1.5. $\vec{x} = \{-5, -5, 5\}$, $\vec{p} = \{-2, 0, 1\}$, $\vec{q} = \{1, 3, -1\}$, $\vec{r} = \{0, 4, 1\}$.

1.6. $\vec{x} = \{13, 2, 7\}$, $\vec{p} = \{5, 1, 0\}$, $\vec{q} = \{2, -1, 3\}$, $\vec{r} = \{1, 0, -1\}$.

1.7. $\vec{x} = \{-19, -1, 7\}$, $\vec{p} = \{0, 1, 1\}$, $\vec{q} = \{-2, 0, 1\}$, $\vec{r} = \{3, 1, 0\}$.

1.8. $\vec{x} = \{3, -3, 4\}$, $\vec{p} = \{1, 0, 2\}$, $\vec{q} = \{0, 1, 1\}$, $\vec{r} = \{2, -1, 4\}$.

1.9. $\vec{x} = \{3, 3, -1\}$, $\vec{p} = \{3, 1, 0\}$, $\vec{q} = \{-1, 2, 1\}$, $\vec{r} = \{-1, 0, 2\}$.

1.10. $\vec{x} = \{-1, 7, -4\}$, $\vec{p} = \{-1, 2, 1\}$, $\vec{q} = \{2, 0, 3\}$, $\vec{r} = \{1, 1, -1\}$.

1.11. $\vec{x} = \{6, 5, -14\}$, $\vec{p} = \{1, 1, 4\}$, $\vec{q} = \{0, -3, 2\}$, $\vec{r} = \{2, 1, -1\}$.

1.12. $\vec{x} = \{6, -1, 7\}$, $\vec{p} = \{1, -2, 0\}$, $\vec{q} = \{-1, 1, 3\}$, $\vec{r} = \{1, 0, 4\}$.

1.13. $\vec{x} = \{5, 15, 0\}$, $\vec{p} = \{1, 0, 5\}$, $\vec{q} = \{-1, 3, 2\}$, $\vec{r} = \{0, -1, 1\}$.

1.14. $\vec{x} = \{2, -1, 11\}$, $\vec{p} = \{1, 1, 0\}$, $\vec{q} = \{0, 1, -2\}$, $\vec{r} = \{1, 0, 3\}$.

1.15. $\vec{x} = \{11, 5, -3\}$, $\vec{p} = \{1, 0, 2\}$, $\vec{q} = \{-1, 0, 1\}$, $\vec{r} = \{2, 5, -3\}$.

1.16. $\vec{x} = \{8, 0, 5\}$, $\vec{p} = \{2, 0, 1\}$, $\vec{q} = \{1, 1, 0\}$, $\vec{r} = \{4, 1, 2\}$.

1.17. $\vec{x} = \{3, 1, 8\}$, $\vec{p} = \{0, 1, 3\}$, $\vec{q} = \{1, 2, -1\}$, $\vec{r} = \{2, 0, -1\}$.

1.18. $\vec{x} = \{8, 1, 12\}$, $\vec{p} = \{1, 2, -1\}$, $\vec{q} = \{3, 0, 2\}$, $\vec{r} = \{-1, 1, 1\}$.

1.19. $\vec{x} = \{-9, -8, -3\}$, $\vec{p} = \{1, 4, 1\}$, $\vec{q} = \{-3, 2, 0\}$, $\vec{r} = \{1, -1, 2\}$.

1.20. $\vec{x} = \{-5, 9, -13\}$, $\vec{p} = \{0, 1, -2\}$, $\vec{q} = \{3, -1, 1\}$, $\vec{r} = \{4, 1, 0\}$.

1.21. $\vec{x} = \{-15, 5, 6\}$, $\vec{p} = \{0, 5, 1\}$, $\vec{q} = \{3, 2, -1\}$, $\vec{r} = \{-1, 1, 0\}$.

1.22. $\vec{x} = \{8, 9, 4\}$, $\vec{p} = \{1, 0, 1\}$, $\vec{q} = \{0, -2, 1\}$, $\vec{r} = \{1, 3, 0\}$.

1.23. $\vec{x} = \{23, -14, -30\}$, $\vec{p} = \{2, 1, 0\}$, $\vec{q} = \{1, -1, 0\}$, $\vec{r} = \{-3, 2, 5\}$.

1.24. $\vec{x} = \{3, 1, 3\}$, $\vec{p} = \{2, 1, 0\}$, $\vec{q} = \{1, 0, 1\}$, $\vec{r} = \{4, 2, 1\}$.

1.25. $\vec{x} = \{-1, 7, 0\}$, $\vec{p} = \{0, 3, 1\}$, $\vec{q} = \{1, -1, 2\}$, $\vec{r} = \{2, -1, 0\}$.

1.26. $\vec{x} = \{11, -1, 4\}$, $\vec{p} = \{1, -1, 2\}$, $\vec{q} = \{3, 2, 0\}$, $\vec{r} = \{-1, 1, 1\}$.

1.27. $\vec{x} = \{-13, 2, 18\}$, $\vec{p} = \{1, 1, 4\}$, $\vec{q} = \{-3, 0, 2\}$, $\vec{r} = \{1, 2, -1\}$.

1.28. $\vec{x} = \{0, -8, 9\}$, $\vec{p} = \{0, -2, 1\}$, $\vec{q} = \{3, 1, -1\}$, $\vec{r} = \{4, 0, 1\}$.

1.29. $\vec{x} = \{8, -7, -13\}$, $\vec{p} = \{0, 1, 5\}$, $\vec{q} = \{3, -1, 2\}$, $\vec{r} = \{-1, 0, 1\}$.

1.30. $\vec{x} = \{2, 7, 5\}$, $\vec{p} = \{1, 0, 1\}$, $\vec{q} = \{1, -2, 0\}$, $\vec{r} = \{0, 3, 1\}$.

Task 2. Check the collinearity of vectors \vec{c}_1 and \vec{c}_2 .

2.1. $\vec{a} = \{1, -2, 3\}$, $\vec{b} = \{3, 0, -1\}$, $\vec{c}_1 = 2\vec{a} + 4\vec{b}$, $\vec{c}_2 = 3\vec{b} - \vec{a}$.

2.2. $\vec{a} = \{1, 0, 1\}$, $\vec{b} = \{-2, 3, 5\}$, $\vec{c}_1 = \vec{a} + 2\vec{b}$, $\vec{c}_2 = 3\vec{a} - \vec{b}$.

2.3. $\vec{a} = \{-2, 4, 1\}$, $\vec{b} = \{1, -2, 7\}$, $\vec{c}_1 = 5\vec{a} + 3\vec{b}$, $\vec{c}_2 = 2\vec{a} - \vec{b}$.

2.4. $\vec{a} = \{1, 2, -3\}$, $\vec{b} = \{2, -1, -1\}$, $\vec{c}_1 = 4\vec{a} + 3\vec{b}$, $\vec{c}_2 = 8\vec{a} - \vec{b}$.

2.5. $\vec{a} = \{3, 5, 4\}$, $\vec{b} = \{5, 9, 7\}$, $\vec{c}_1 = -2\vec{a} + \vec{b}$, $\vec{c}_2 = 3\vec{a} - 2\vec{b}$.

2.6. $\vec{a} = \{1, 4, -2\}$, $\vec{b} = \{1, 1, -1\}$, $\vec{c}_1 = \vec{a} + \vec{b}$, $\vec{c}_2 = 4\vec{a} + 2\vec{b}$.

2.7. $\vec{a} = \{1, -2, 5\}$, $\vec{b} = \{3, -1, 0\}$, $\vec{c}_1 = 4\vec{a} - 2\vec{b}$, $\vec{c}_2 = \vec{b} - 2\vec{a}$.

2.8. $\vec{a} = \{3, 4, -1\}$, $\vec{b} = \{2, -1, 1\}$, $\vec{c}_1 = 6\vec{a} - 3\vec{b}$, $\vec{c}_2 = \vec{b} - 2\vec{a}$.

2.9. $\vec{a} = \{-2, -3, -2\}$, $\vec{b} = \{1, 0, 5\}$, $\vec{c}_1 = 3\vec{a} + 9\vec{b}$, $\vec{c}_2 = -\vec{a} - 3\vec{b}$.

2.10. $\vec{a} = \{-1, 4, 2\}$, $\vec{b} = \{3, -2, 6\}$, $\vec{c}_1 = 2\vec{a} - \vec{b}$, $\vec{c}_2 = 3\vec{b} - 6\vec{a}$.

2.11. $\vec{a} = \{5, 0, -1\}$, $\vec{b} = \{7, 2, 3\}$, $\vec{c}_1 = 2\vec{a} - \vec{b}$, $\vec{c}_2 = 3\vec{b} - 6\vec{a}$.

2.12. $\vec{a} = \{0, 3, -2\}$, $\vec{b} = \{1, -2, 1\}$, $\vec{c}_1 = 5\vec{a} - 2\vec{b}$, $\vec{c}_2 = 3\vec{a} + 5\vec{b}$.

2.13. $\vec{a} = \{-2, 7, -1\}$, $\vec{b} = \{-3, 5, 2\}$, $\vec{c}_1 = 2\vec{a} + 3\vec{b}$, $\vec{c}_2 = 3\vec{a} + 2\vec{b}$.

2.14. $\vec{a} = \{3, 7, 0\}$, $\vec{b} = \{1, -3, 4\}$, $\vec{c}_1 = 4\vec{a} - 2\vec{b}$, $\vec{c}_2 = \vec{b} - 2\vec{a}$.

2.15. $\vec{a} = \{-1, 2, -1\}$, $\vec{b} = \{2, -7, 1\}$, $\vec{c}_1 = 6\vec{a} - 2\vec{b}$, $\vec{c}_2 = \vec{b} - 3\vec{a}$.

2.16. $\vec{a} = \{7, 9, -2\}$, $\vec{b} = \{5, 4, 3\}$, $\vec{c}_1 = 4\vec{a} - \vec{b}$, $\vec{c}_2 = 4\vec{b} - \vec{a}$.

2.17. $\vec{a} = \{5, 0, -2\}$, $\vec{b} = \{6, 4, 3\}$, $\vec{c}_1 = 5\vec{a} - 3\vec{b}$, $\vec{c}_2 = 6\vec{b} - 10\vec{a}$.

2.18. $\vec{a} = \{8, 3, -1\}$, $\vec{b} = \{4, 1, 3\}$, $\vec{c}_1 = 2\vec{a} - \vec{b}$, $\vec{c}_2 = 2\vec{b} - 4\vec{a}$.

2.19. $\vec{a} = \{3, -1, 6\}$, $\vec{b} = \{5, 7, 10\}$, $\vec{c}_1 = 4\vec{a} - 2\vec{b}$, $\vec{c}_2 = \vec{b} - 2\vec{a}$.

2.20. $\vec{a} = \{1, -2, 4\}$, $\vec{b} = \{7, 3, 5\}$, $\vec{c}_1 = 6\vec{a} - 3\vec{b}$, $\vec{c}_2 = \vec{b} - 2\vec{a}$.

2.21. $\vec{a} = \{3, 7, 0\}$, $\vec{b} = \{4, 6, -1\}$, $\vec{c}_1 = 3\vec{a} + 2\vec{b}$, $\vec{c}_2 = 5\vec{a} - 7\vec{b}$.

2.22. $\vec{a} = \{2, -1, 4\}$, $\vec{b} = \{3, -7, -6\}$, $\vec{c}_1 = 2\vec{a} - 3\vec{b}$, $\vec{c}_2 = 3\vec{a} - 2\vec{b}$.

2.23. $\vec{a} = \{5, -1, -2\}$, $\vec{b} = \{6, 0, 7\}$, $\vec{c}_1 = 3\vec{a} - 2\vec{b}$, $\vec{c}_2 = 4\vec{b} - 6\vec{a}$.

2.24. $\vec{a} = \{-9, 5, 3\}$, $\vec{b} = \{7, 1, -2\}$, $\vec{c}_1 = 2\vec{a} - \vec{b}$, $\vec{c}_2 = 3\vec{a} + 5\vec{b}$.

2.25. $\vec{a} = \{4, 2, 9\}$, $\vec{b} = \{0, -1, 3\}$, $\vec{c}_1 = 4\vec{b} - 3\vec{a}$, $\vec{c}_2 = 4\vec{a} - 3\vec{b}$.

2.26. $\vec{a} = \{2, -1, 6\}$, $\vec{b} = \{-1, 3, 8\}$, $\vec{c}_1 = 5\vec{a} - 2\vec{b}$, $\vec{c}_2 = 2\vec{a} - 5\vec{b}$.

2.27. $\vec{a} = \{5, 0, 8\}$, $\vec{b} = \{-3, 1, 7\}$, $\vec{c}_1 = 3\vec{a} - 4\vec{b}$, $\vec{c}_2 = 12\vec{b} - 9\vec{a}$.

2.28. $\vec{a} = \{-1, 3, 4\}$, $\vec{b} = \{2, -1, 0\}$, $\vec{c}_1 = 6\vec{a} - 2\vec{b}$, $\vec{c}_2 = \vec{b} - 3\vec{a}$.

2.29. $\vec{a} = \{4, 2, -7\}$, $\vec{b} = \{5, 0, -3\}$, $\vec{c}_1 = \vec{a} - 3\vec{b}$, $\vec{c}_2 = 6\vec{b} - 2\vec{a}$.

2.30. $\vec{a} = \{2, 0, -5\}$, $\vec{b} = \{1, -3, 4\}$, $\vec{c}_1 = 2\vec{a} - 5\vec{b}$, $\vec{c}_2 = 5\vec{a} - 2\vec{b}$.

Task 3. Find cosine of angle between vectors \overline{AB} and \overline{AC} .

3.1. $A(1, -2, 3)$, $B(0, -1, 2)$, $C(3, -4, 5)$.

3.2. $A(0, -3, 6)$, $B(-12, -3, -3)$, $C(-9, -3, -6)$.

3.3. $A(3, 3, -1)$, $B(5, 5, -2)$, $C(4, 1, 1)$.

3.4. $A(-1, 2, -3)$, $B(3, 4, -6)$, $C(1, 1, -1)$.

3.5. $A(-4, -2, 0)$, $B(-1, -2, 4)$, $C(3, -2, 1)$.

3.6. $A(5, 3, -1)$, $B(5, 2, 0)$, $C(6, 4, -1)$.

3.7. $A(-3, -7, -5)$, $B(0, -1, -2)$, $C(2, 3, 0)$.

3.8. $A(2, -4, 6)$, $B(0, -2, 4)$, $C(6, -8, 10)$.

3.9. $A(0, 1, -2)$, $B(3, 1, 2)$, $C(4, 1, 1)$.

3.10. $A(3, 3, -1)$, $B(1, 5, -2)$, $C(4, 1, 1)$.

- 3.11. $A(2, 1, -1)$, $B(6, -1, -4)$, $C(4, 2, 1)$.
- 3.12. $A(-1, -2, 1)$, $B(-4, -2, 5)$, $C(-8, -2, 2)$.
- 3.13. $A(6, 2, -3)$, $B(6, 3, -2)$, $C(7, 3, -3)$.
- 3.14. $A(0, 0, 4)$, $B(-3, -6, 1)$, $C(-5, -10, -1)$.
- 3.15. $A(2, -8, -1)$, $B(4, -6, 0)$, $C(-2, -5, -1)$.
- 3.16. $A(3, -6, 9)$, $B(0, -3, 6)$, $C(9, -12, 15)$.
- 3.17. $A(0, 2, -4)$, $B(8, 2, 2)$, $C(6, 2, 4)$.
- 3.18. $A(3, 3, -1)$, $B(5, 1, -2)$, $C(4, 1, 1)$.
- 3.19. $A(-4, 3, 0)$, $B(0, 1, 3)$, $C(-2, 4, -2)$.
- 3.20. $A(1, -1, 0)$, $B(-2, -1, 4)$, $C(8, -1, -1)$.
- 3.21. $A(7, 0, 2)$, $B(7, 1, 3)$, $C(8, -1, 2)$.
- 3.22. $A(2, 3, 2)$, $B(-1, -3, -1)$, $C(-3, -7, -3)$.
- 3.23. $A(2, 2, 7)$, $B(0, 0, 6)$, $C(-2, 5, 7)$.
- 3.24. $A(-1, 2, -3)$, $B(0, 1, -2)$, $C(-3, 4, -5)$.
- 3.25. $A(0, 3, -6)$, $B(9, 3, 6)$, $C(12, 3, 3)$.
- 3.26. $A(3, 3, -1)$, $B(5, 1, -2)$, $C(4, 1, -3)$.
- 3.27. $A(-2, 1, 1)$, $B(2, 3, -2)$, $C(0, 0, 3)$.
- 3.28. $A(1, 4, -1)$, $B(-2, 4, -5)$, $C(8, 4, 0)$.
- 3.29. $A(0, 1, 0)$, $B(0, 2, 1)$, $C(1, 2, 0)$.
- 3.30. $A(-4, 0, 4)$, $B(-1, 6, 7)$, $C(1, 10, 9)$.

Task 4. Find projection of the vector \vec{a} on the direction of the vector \vec{b} .

- 4.1. $\vec{a} = \vec{p} + 2\vec{q}$, $\vec{b} = 3\vec{p} - \vec{q}$; $|\vec{p}| = 1$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/6$.
- 4.2. $\vec{a} = 3\vec{p} + \vec{q}$, $\vec{b} = \vec{p} - 2\vec{q}$; $|\vec{p}| = 4$, $|\vec{q}| = 1$, $(\vec{p} \wedge \vec{q}) = \pi/4$.
- 4.3. $\vec{a} = \vec{p} - 3\vec{q}$, $\vec{b} = \vec{p} + 2\vec{q}$; $|\vec{p}| = 1/5$, $|\vec{q}| = 1$, $(\vec{p} \wedge \vec{q}) = \pi/2$.
- 4.4. $\vec{a} = 3\vec{p} - 2\vec{q}$, $\vec{b} = \vec{p} + 5\vec{q}$; $|\vec{p}| = 4$, $|\vec{q}| = 1/2$, $(\vec{p} \wedge \vec{q}) = 5\pi/6$.

- 4.5. $\vec{a} = \vec{p} - 2\vec{q}$, $\vec{b} = 2\vec{p} + \vec{q}$; $|\vec{p}| = 2$, $|\vec{q}| = 3$, $(\vec{p} \wedge \vec{q}) = 3\pi/4$.
- 4.6. $\vec{a} = \vec{p} + 3\vec{q}$, $\vec{b} = \vec{p} - 2\vec{q}$; $|\vec{p}| = 2$, $|\vec{q}| = 3$, $(\vec{p} \wedge \vec{q}) = \pi/3$.
- 4.7. $\vec{a} = 2\vec{p} - \vec{q}$, $\vec{b} = \vec{p} + 3\vec{q}$; $|\vec{p}| = 3$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/2$.
- 4.8. $\vec{a} = 4\vec{p} + \vec{q}$, $\vec{b} = \vec{p} - \vec{q}$; $|\vec{p}| = 7$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/4$.
- 4.9. $\vec{a} = \vec{p} - 4\vec{q}$, $\vec{b} = 3\vec{p} + \vec{q}$; $|\vec{p}| = 1$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/6$.
- 4.10. $\vec{a} = \vec{p} + 4\vec{q}$, $\vec{b} = 2\vec{p} - \vec{q}$; $|\vec{p}| = 7$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/3$.
- 4.11. $\vec{a} = 3\vec{p} + 2\vec{q}$, $\vec{b} = \vec{p} - \vec{q}$; $|\vec{p}| = 10$, $|\vec{q}| = 1$, $(\vec{p} \wedge \vec{q}) = \pi/2$.
- 4.12. $\vec{a} = 4\vec{p} - \vec{q}$, $\vec{b} = \vec{p} + 2\vec{q}$; $|\vec{p}| = 5$, $|\vec{q}| = 4$, $(\vec{p} \wedge \vec{q}) = \pi/4$.
- 4.13. $\vec{a} = 2\vec{p} + 3\vec{q}$, $\vec{b} = \vec{p} - 2\vec{q}$; $|\vec{p}| = 6$, $|\vec{q}| = 7$, $(\vec{p} \wedge \vec{q}) = \pi/3$.
- 4.14. $\vec{a} = 3\vec{p} - \vec{q}$, $\vec{b} = \vec{p} + 2\vec{q}$; $|\vec{p}| = 3$, $|\vec{q}| = 4$, $(\vec{p} \wedge \vec{q}) = \pi/3$.
- 4.15. $\vec{a} = 2\vec{p} + 3\vec{q}$, $\vec{b} = \vec{p} - 2\vec{q}$; $|\vec{p}| = 2$, $|\vec{q}| = 3$, $(\vec{p} \wedge \vec{q}) = \pi/4$.
- 4.16. $\vec{a} = 2\vec{p} - 3\vec{q}$, $\vec{b} = 3\vec{p} + \vec{q}$; $|\vec{p}| = 4$, $|\vec{q}| = 1$, $(\vec{p} \wedge \vec{q}) = \pi/6$.
- 4.17. $\vec{a} = 5\vec{p} + \vec{q}$, $\vec{b} = \vec{p} - 3\vec{q}$; $|\vec{p}| = 1$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/3$.
- 4.18. $\vec{a} = 7\vec{p} - 2\vec{q}$, $\vec{b} = \vec{p} + 3\vec{q}$; $|\vec{p}| = 1/2$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/2$.
- 4.19. $\vec{a} = 6\vec{p} - \vec{q}$, $\vec{b} = \vec{p} + \vec{q}$; $|\vec{p}| = 3$, $|\vec{q}| = 4$, $(\vec{p} \wedge \vec{q}) = \pi/4$.
- 4.20. $\vec{a} = 10\vec{p} + \vec{q}$, $\vec{b} = 3\vec{p} - 2\vec{q}$; $|\vec{p}| = 4$, $|\vec{q}| = 1$, $(\vec{p} \wedge \vec{q}) = \pi/6$.
- 4.21. $\vec{a} = 6\vec{p} - \vec{q}$, $\vec{b} = \vec{p} + 2\vec{q}$; $|\vec{p}| = 8$, $|\vec{q}| = 1/2$, $(\vec{p} \wedge \vec{q}) = \pi/3$.
- 4.22. $\vec{a} = 3\vec{p} + 4\vec{q}$, $\vec{b} = \vec{q} - \vec{p}$; $|\vec{p}| = 2,5$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/2$.
- 4.23. $\vec{a} = 7\vec{p} + \vec{q}$, $\vec{b} = \vec{p} - 3\vec{q}$; $|\vec{p}| = 3$, $|\vec{q}| = 1$, $(\vec{p} \wedge \vec{q}) = 3\pi/4$.
- 4.24. $\vec{a} = \vec{p} + 3\vec{q}$, $\vec{b} = 3\vec{p} - \vec{q}$; $|\vec{p}| = 3$, $|\vec{q}| = 5$, $(\vec{p} \wedge \vec{q}) = 2\pi/3$.
- 4.25. $\vec{a} = 3\vec{p} + \vec{q}$, $\vec{b} = \vec{p} - 3\vec{q}$; $|\vec{p}| = 7$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/4$.
- 4.26. $\vec{a} = 5\vec{p} - \vec{q}$, $\vec{b} = \vec{p} + \vec{q}$; $|\vec{p}| = 5$, $|\vec{q}| = 3$, $(\vec{p} \wedge \vec{q}) = 5\pi/6$.
- 4.27. $\vec{a} = 3\vec{p} - 4\vec{q}$, $\vec{b} = \vec{p} + 3\vec{q}$; $|\vec{p}| = 2$, $|\vec{q}| = 3$, $(\vec{p} \wedge \vec{q}) = \pi/4$.

4.28. $\vec{a} = 6\vec{p} - \vec{q}$, $\vec{b} = 5\vec{q} + \vec{p}$; $|\vec{p}| = 1/2$, $|\vec{q}| = 4$, $(\vec{p} \wedge \vec{q}) = 5\pi/6$.

4.29. $\vec{a} = 2\vec{p} + 3\vec{q}$, $\vec{b} = \vec{p} - 2\vec{q}$; $|\vec{p}| = 2$, $|\vec{q}| = 1$, $(\vec{p} \wedge \vec{q}) = \pi/3$.

4.30. $\vec{a} = 2\vec{p} - 3\vec{q}$, $\vec{b} = 5\vec{p} + \vec{q}$; $|\vec{p}| = 2$, $|\vec{q}| = 3$, $(\vec{p} \wedge \vec{q}) = \pi/2$.

Task 5. Find area of the triangle constructed on vectors \vec{a} and \vec{b} and the value of altitude dropped on side of the vector \vec{a} .

5.1. $\vec{a} = \vec{i} - 2\vec{j} + 3\vec{k}$, $\vec{b} = 3\vec{i} - \vec{k}$.

5.2. $\vec{a} = \vec{i} + \vec{k}$, $\vec{b} = -2\vec{i} + 3\vec{j} + 5\vec{k}$.

5.3. $\vec{a} = -2\vec{i} + 4\vec{j} + \vec{k}$, $\vec{b} = \vec{i} - 2\vec{j} + 7\vec{k}$.

5.4. $\vec{a} = \vec{i} + 2\vec{j} - 3\vec{k}$, $\vec{b} = 2\vec{i} - \vec{j} - \vec{k}$.

5.5. $\vec{a} = 3\vec{i} + 5\vec{j} + 4\vec{k}$, $\vec{b} = 5\vec{i} + 9\vec{j} + 7\vec{k}$.

5.6. $\vec{a} = \vec{i} + 4\vec{j} - 2\vec{k}$, $\vec{b} = \vec{i} + \vec{j} - \vec{k}$.

5.7. $\vec{a} = \vec{i} - 2\vec{j} + 5\vec{k}$, $\vec{b} = 3\vec{i} - \vec{j}$.

5.8. $\vec{a} = 3\vec{i} + 4\vec{j} - \vec{k}$, $\vec{b} = 2\vec{i} - \vec{j} + \vec{k}$.

5.9. $\vec{a} = -2\vec{i} - 3\vec{j} - 2\vec{k}$, $\vec{b} = \vec{i} + 5\vec{k}$.

5.10. $\vec{a} = -\vec{i} + 4\vec{j} + 2\vec{k}$, $\vec{b} = 3\vec{i} - 2\vec{j} + 6\vec{k}$.

5.11. $\vec{a} = 5\vec{i} - \vec{k}$, $\vec{b} = 7\vec{i} + 2\vec{j} + 3\vec{k}$.

5.12. $\vec{a} = 3\vec{j} - 2\vec{k}$, $\vec{b} = \vec{i} - 2\vec{j} + \vec{k}$.

5.13. $\vec{a} = -2\vec{i} + 7\vec{j} - \vec{k}$, $\vec{b} = -3\vec{i} + 5\vec{j} + 2\vec{k}$.

5.14. $\vec{a} = 3\vec{i} + 7\vec{j}$, $\vec{b} = \vec{i} - 3\vec{j} + 4\vec{k}$.

5.15. $\vec{a} = -\vec{i} + 2\vec{j} - \vec{k}$, $\vec{b} = 2\vec{i} - 7\vec{j} + \vec{k}$.

5.16. $\vec{a} = 7\vec{i} + 9\vec{j} - 2\vec{k}$, $\vec{b} = 5\vec{i} + 4\vec{j} + 3\vec{k}$.

5.17. $\vec{a} = 5\vec{i} - 2\vec{k}$, $\vec{b} = 6\vec{i} + 4\vec{j} + 3\vec{k}$.

5.18. $\vec{a} = 8\vec{i} + 3\vec{j} - \vec{k}$, $\vec{b} = 4\vec{i} + \vec{j} + 3\vec{k}$.

5.19. $\vec{a} = 3\vec{i} - \vec{j} + 6\vec{k}$, $\vec{b} = 5\vec{i} + 7\vec{j} + 10\vec{k}$.

5.20. $\vec{a} = \vec{i} - 2\vec{j} + 4\vec{k}$, $\vec{b} = 7\vec{i} + 3\vec{j} + 5\vec{k}$.

5.21. $\vec{a} = 3\vec{i} + 7\vec{j}$, $\vec{b} = 4\vec{i} + 6\vec{j} - \vec{k}$.

5.22. $\vec{a} = 2\vec{i} - \vec{j} + 4\vec{k}$, $\vec{b} = 3\vec{i} - 7\vec{j} - 6\vec{k}$.

5.23. $\vec{a} = 5\vec{i} - \vec{j} - 2\vec{k}$, $\vec{b} = 6\vec{i} + 7\vec{k}$.

5.24. $\vec{a} = -9\vec{i} + 5\vec{j} + 3\vec{k}$, $\vec{b} = 7\vec{i} + \vec{j} - 2\vec{k}$.

5.25. $\vec{a} = 4\vec{i} + 2\vec{j} + 9\vec{k}$, $\vec{b} = -\vec{j} + 3\vec{k}$.

5.26. $\vec{a} = 2\vec{i} - \vec{j} + 6\vec{k}$, $\vec{b} = -\vec{i} + 3\vec{j} + 8\vec{k}$.

5.27. $\vec{a} = 5\vec{i} + 8\vec{k}$, $\vec{b} = -3\vec{i} + \vec{j} + 7\vec{k}$.

5.28. $\vec{a} = -\vec{i} + 3\vec{j} + 4\vec{k}$, $\vec{b} = 2\vec{i} - \vec{j}$.

5.29. $\vec{a} = 4\vec{i} + 2\vec{j} - 7\vec{k}$, $\vec{b} = 5\vec{i} - 3\vec{k}$.

5.30. $\vec{a} = 2\vec{i} - 5\vec{k}$, $\vec{b} = \vec{i} - 3\vec{j} + 4\vec{k}$.

Task 6. Find area of parallelogram constructed on vectors \vec{a} and \vec{b} .

6.1. $\vec{a} = \vec{p} + 2\vec{q}$, $\vec{b} = 3\vec{p} - \vec{q}$; $|\vec{p}| = 1$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/6$.

6.2. $\vec{a} = 3\vec{p} + \vec{q}$, $\vec{b} = \vec{p} - 2\vec{q}$; $|\vec{p}| = 4$, $|\vec{q}| = 1$, $(\vec{p} \wedge \vec{q}) = \pi/4$.

6.3. $\vec{a} = \vec{p} - 3\vec{q}$, $\vec{b} = \vec{p} + 2\vec{q}$; $|\vec{p}| = 1/5$, $|\vec{q}| = 1$, $(\vec{p} \wedge \vec{q}) = \pi/2$.

6.4. $\vec{a} = 3\vec{p} - 2\vec{q}$, $\vec{b} = \vec{p} + 5\vec{q}$; $|\vec{p}| = 4$, $|\vec{q}| = 1/2$, $(\vec{p} \wedge \vec{q}) = 5\pi/6$.

6.5. $\vec{a} = \vec{p} - 2\vec{q}$, $\vec{b} = 2\vec{p} + \vec{q}$; $|\vec{p}| = 2$, $|\vec{q}| = 3$, $(\vec{p} \wedge \vec{q}) = 3\pi/4$.

6.6. $\vec{a} = \vec{p} + 3\vec{q}$, $\vec{b} = \vec{p} - 2\vec{q}$; $|\vec{p}| = 2$, $|\vec{q}| = 3$, $(\vec{p} \wedge \vec{q}) = \pi/3$.

6.7. $\vec{a} = 2\vec{p} - \vec{q}$, $\vec{b} = \vec{p} + 3\vec{q}$; $|\vec{p}| = 3$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/2$.

6.8. $\vec{a} = 4\vec{p} + \vec{q}$, $\vec{b} = \vec{p} - \vec{q}$; $|\vec{p}| = 7$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/4$.

6.9. $\vec{a} = \vec{p} - 4\vec{q}$, $\vec{b} = 3\vec{p} + \vec{q}$; $|\vec{p}| = 1$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/6$.

6.10. $\vec{a} = \vec{p} + 4\vec{q}$, $\vec{b} = 2\vec{p} - \vec{q}$; $|\vec{p}| = 7$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/3$.

6.11. $\vec{a} = 3\vec{p} + 2\vec{q}$, $\vec{b} = \vec{p} - \vec{q}$; $|\vec{p}| = 10$, $|\vec{q}| = 1$, $(\vec{p} \wedge \vec{q}) = \pi/2$.

- 6.12. $\vec{a} = 4\vec{p} - \vec{q}$, $\vec{b} = \vec{p} + 2\vec{q}$; $|\vec{p}| = 5$, $|\vec{q}| = 4$, $(\vec{p} \wedge \vec{q}) = \pi/4$.
- 6.13. $\vec{a} = 2\vec{p} + 3\vec{q}$, $\vec{b} = \vec{p} - 2\vec{q}$; $|\vec{p}| = 6$, $|\vec{q}| = 7$, $(\vec{p} \wedge \vec{q}) = \pi/3$.
- 6.14. $\vec{a} = 3\vec{p} - \vec{q}$, $\vec{b} = \vec{p} + 2\vec{q}$; $|\vec{p}| = 3$, $|\vec{q}| = 4$, $(\vec{p} \wedge \vec{q}) = \pi/3$.
- 6.15. $\vec{a} = 2\vec{p} + 3\vec{q}$, $\vec{b} = \vec{p} - 2\vec{q}$; $|\vec{p}| = 2$, $|\vec{q}| = 3$, $(\vec{p} \wedge \vec{q}) = \pi/4$.
- 6.16. $\vec{a} = 2\vec{p} - 3\vec{q}$, $\vec{b} = 3\vec{p} + \vec{q}$; $|\vec{p}| = 4$, $|\vec{q}| = 1$, $(\vec{p} \wedge \vec{q}) = \pi/6$.
- 6.17. $\vec{a} = 5\vec{p} + \vec{q}$, $\vec{b} = \vec{p} - 3\vec{q}$; $|\vec{p}| = 1$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/3$.
- 6.18. $\vec{a} = 7\vec{p} - 2\vec{q}$, $\vec{b} = \vec{p} + 3\vec{q}$; $|\vec{p}| = 1/2$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/2$.
- 6.19. $\vec{a} = 6\vec{p} - \vec{q}$, $\vec{b} = \vec{p} + \vec{q}$; $|\vec{p}| = 3$, $|\vec{q}| = 4$, $(\vec{p} \wedge \vec{q}) = \pi/4$.
- 6.20. $\vec{a} = 10\vec{p} + \vec{q}$, $\vec{b} = 3\vec{p} - 2\vec{q}$; $|\vec{p}| = 4$, $|\vec{q}| = 1$, $(\vec{p} \wedge \vec{q}) = \pi/6$.
- 6.21. $\vec{a} = 6\vec{p} - \vec{q}$, $\vec{b} = \vec{p} + 2\vec{q}$; $|\vec{p}| = 8$, $|\vec{q}| = 1/2$, $(\vec{p} \wedge \vec{q}) = \pi/3$.
- 6.22. $\vec{a} = 3\vec{p} + 4\vec{q}$, $\vec{b} = \vec{q} - \vec{p}$; $|\vec{p}| = 2,5$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/2$.
- 6.23. $\vec{a} = 7\vec{p} + \vec{q}$, $\vec{b} = \vec{p} - 3\vec{q}$; $|\vec{p}| = 3$, $|\vec{q}| = 1$, $(\vec{p} \wedge \vec{q}) = 3\pi/4$.
- 6.24. $\vec{a} = \vec{p} + 3\vec{q}$, $\vec{b} = 3\vec{p} - \vec{q}$; $|\vec{p}| = 3$, $|\vec{q}| = 5$, $(\vec{p} \wedge \vec{q}) = 2\pi/3$.
- 6.25. $\vec{a} = 3\vec{p} + \vec{q}$, $\vec{b} = \vec{p} - 3\vec{q}$; $|\vec{p}| = 7$, $|\vec{q}| = 2$, $(\vec{p} \wedge \vec{q}) = \pi/4$.
- 6.26. $\vec{a} = 5\vec{p} - \vec{q}$, $\vec{b} = \vec{p} + \vec{q}$; $|\vec{p}| = 5$, $|\vec{q}| = 3$, $(\vec{p} \wedge \vec{q}) = 5\pi/6$.
- 6.27. $\vec{a} = 3\vec{p} - 4\vec{q}$, $\vec{b} = \vec{p} + 3\vec{q}$; $|\vec{p}| = 2$, $|\vec{q}| = 3$, $(\vec{p} \wedge \vec{q}) = \pi/4$.
- 6.28. $\vec{a} = 6\vec{p} - \vec{q}$, $\vec{b} = 5\vec{q} + \vec{p}$; $|\vec{p}| = 1/2$, $|\vec{q}| = 4$, $(\vec{p} \wedge \vec{q}) = 5\pi/6$.
- 6.29. $\vec{a} = 2\vec{p} + 3\vec{q}$, $\vec{b} = \vec{p} - 2\vec{q}$; $|\vec{p}| = 2$, $|\vec{q}| = 1$, $(\vec{p} \wedge \vec{q}) = \pi/3$.
- 6.30. $\vec{a} = 2\vec{p} - 3\vec{q}$, $\vec{b} = 5\vec{p} + \vec{q}$; $|\vec{p}| = 2$, $|\vec{q}| = 3$, $(\vec{p} \wedge \vec{q}) = \pi/2$.

Task 7. Are the vectors \vec{a} , \vec{b} and \vec{c} coplanar or not?

7.1. $\vec{a} = \{2, 3, 1\}$, $\vec{b} = \{-1, 0, -1\}$, $\vec{c} = \{2, 2, 2\}$.

7.2. $\vec{a} = \{3, 2, 1\}$, $\vec{b} = \{2, 3, 4\}$, $\vec{c} = \{3, 1, -1\}$.

7.3. $\vec{a} = \{1, 5, 2\}$, $\vec{b} = \{-1, 1, -1\}$, $\vec{c} = \{1, 1, 1\}$.

7.4. $\vec{a} = \{1, -1, -3\}$, $\vec{b} = \{3, 2, 1\}$, $\vec{c} = \{2, 3, 4\}$.

7.5. $\vec{a} = \{3, 3, 1\}$, $\vec{b} = \{1, -2, 1\}$, $\vec{c} = \{1, 1, 1\}$.

7.6. $\vec{a} = \{3, 1, -1\}$, $\vec{b} = \{-2, -1, 0\}$, $\vec{c} = \{5, 2, -1\}$.

7.7. $\vec{a} = \{4, 3, 1\}$, $\vec{b} = \{1, -2, 1\}$, $\vec{c} = \{2, 2, 2\}$.

7.8. $\vec{a} = \{4, 3, 1\}$, $\vec{b} = \{6, 7, 4\}$, $\vec{c} = \{2, 0, -1\}$.

7.9. $\vec{a} = \{3, 2, 1\}$, $\vec{b} = \{1, -3, -7\}$, $\vec{c} = \{1, 2, 3\}$.

7.10. $\vec{a} = \{3, 7, 2\}$, $\vec{b} = \{-2, 0, -1\}$, $\vec{c} = \{2, 2, 1\}$.

7.11. $\vec{a} = \{1, -2, 6\}$, $\vec{b} = \{1, 0, 1\}$, $\vec{c} = \{2, -6, 17\}$.

7.12. $\vec{a} = \{6, 3, 4\}$, $\vec{b} = \{-1, -2, -1\}$, $\vec{c} = \{2, 1, 2\}$.

7.13. $\vec{a} = \{7, 3, 4\}$, $\vec{b} = \{-1, -2, -1\}$, $\vec{c} = \{4, 2, 4\}$.

7.14. $\vec{a} = \{2, 3, 2\}$, $\vec{b} = \{4, 7, 5\}$, $\vec{c} = \{2, 0, -1\}$.

7.15. $\vec{a} = \{5, 3, 4\}$, $\vec{b} = \{-1, 0, -1\}$, $\vec{c} = \{4, 2, 4\}$.

7.16. $\vec{a} = \{3, 10, 5\}$, $\vec{b} = \{-2, -2, -3\}$, $\vec{c} = \{2, 4, 3\}$.

7.17. $\vec{a} = \{-2, -4, -3\}$, $\vec{b} = \{4, 3, 1\}$, $\vec{c} = \{6, 7, 4\}$.

7.18. $\vec{a} = \{3, 1, -1\}$, $\vec{b} = \{1, 0, -1\}$, $\vec{c} = \{8, 3, -2\}$.

7.19. $\vec{a} = \{4, 2, 2\}$, $\vec{b} = \{-3, -3, -3\}$, $\vec{c} = \{2, 1, 2\}$.

7.20. $\vec{a} = \{4, 1, 2\}$, $\vec{b} = \{9, 2, 5\}$, $\vec{c} = \{1, 1, -1\}$.

7.21. $\vec{a} = \{5, 3, 4\}$, $\vec{b} = \{4, 3, 3\}$, $\vec{c} = \{9, 5, 8\}$.

7.22. $\vec{a} = \{3, 4, 2\}$, $\vec{b} = \{1, 1, 0\}$, $\vec{c} = \{8, 11, 6\}$.

7.23. $\vec{a} = \{4, -1, -6\}$, $\vec{b} = \{1, -3, -7\}$, $\vec{c} = \{2, -1, -4\}$.

7.24. $\vec{a} = \{3, 1, 0\}$, $\vec{b} = \{-5, -4, -5\}$, $\vec{c} = \{4, 2, 4\}$.

7.25. $\vec{a} = \{3, 0, 3\}$, $\vec{b} = \{8, 1, 6\}$, $\vec{c} = \{1, 1, -1\}$.

7.26. $\vec{a} = \{1, -1, 4\}$, $\vec{b} = \{1, 0, 3\}$, $\vec{c} = \{1, -3, 8\}$.

7.27. $\vec{a} = \{6, 3, 4\}$, $\vec{b} = \{-1, -2, -1\}$, $\vec{c} = \{2, 1, 2\}$.

7.28. $\vec{a} = \{4, 1, 1\}$, $\vec{b} = \{-9, -4, -9\}$, $\vec{c} = \{6, 2, 6\}$.

7.29. $\vec{a} = \{-3, 3, 3\}$, $\vec{b} = \{-4, 7, 6\}$, $\vec{c} = \{3, 0, -1\}$.

7.30. $\vec{a} = \{-7, 10, -5\}$, $\vec{b} = \{0, -2, -1\}$, $\vec{c} = \{-2, 4, -1\}$.

Task 8. Find the volume of the tetrahedron with vertices A_1, A_2, A_3, A_4 and its altitude dropped from A_4 on the base $A_1A_2A_3$.

8.1. $A_1(1, 3, 6)$, $A_2(2, 2, 1)$, $A_3(-1, 0, 1)$, $A_4(-4, 6, -3)$.

8.2. $A_1(-4, 2, 6)$, $A_2(2, -3, 0)$, $A_3(-10, 5, 8)$, $A_4(-5, 2, -4)$.

8.3. $A_1(7, 2, 4)$, $A_2(7, -1, -2)$, $A_3(3, 3, 1)$, $A_4(-4, 2, 1)$.

8.4. $A_1(2, 1, 4)$, $A_2(-1, 5, -2)$, $A_3(-7, -3, 2)$, $A_4(-6, -3, 6)$.

8.5. $A_1(-1, -5, 2)$, $A_2(-6, 0, -3)$, $A_3(3, 6, -3)$, $A_4(-10, 6, 7)$.

8.6. $A_1(0, -1, -1)$, $A_2(-2, 3, 5)$, $A_3(1, -5, -9)$, $A_4(-1, -6, 3)$.

8.7. $A_1(5, 2, 0)$, $A_2(2, 5, 0)$, $A_3(1, 2, 4)$, $A_4(-1, 1, 1)$.

8.8. $A_1(2, -1, -2)$, $A_2(1, 2, 1)$, $A_3(5, 0, -6)$, $A_4(-10, 9, -7)$.

8.9. $A_1(-2, 0, -4)$, $A_2(-1, 7, 1)$, $A_3(4, -8, -4)$, $A_4(1, -4, 6)$.

8.10. $A_1(14, 4, 5)$, $A_2(-5, -3, 2)$, $A_3(-2, -6, -3)$, $A_4(-2, 2, -1)$.

8.11. $A_1(1, 2, 0)$, $A_2(3, 0, -3)$, $A_3(5, 2, 6)$, $A_4(8, 4, -9)$.

8.12. $A_1(2, -1, 2)$, $A_2(1, 2, -1)$, $A_3(3, 2, 1)$, $A_4(-4, 2, 5)$.

8.13. $A_1(1, 1, 2)$, $A_2(-1, 1, 3)$, $A_3(2, -2, 4)$, $A_4(-1, 0, -2)$.

8.14. $A_1(2, 3, 1)$, $A_2(4, 1, -2)$, $A_3(6, 3, 7)$, $A_4(7, 5, -3)$.

8.15. $A_1(1, 1, -1)$, $A_2(2, 3, 1)$, $A_3(3, 2, 1)$, $A_4(5, 9, -8)$.

8.16. $A_1(1, 5, -7)$, $A_2(-3, 6, 3)$, $A_3(-2, 7, 3)$, $A_4(-4, 8, -12)$.

8.17. $A_1(-3, 4, -7)$, $A_2(1, 5, -4)$, $A_3(-5, -2, 0)$, $A_4(2, 5, 4)$.

8.18. $A_1(-1, 2, -3)$, $A_2(4, -1, 0)$, $A_3(2, 1, -2)$, $A_4(3, 4, 5)$.

8.19. $A_1(4, -1, 3)$, $A_2(-2, 1, 0)$, $A_3(0, -5, 1)$, $A_4(3, 2, -6)$.

8.20. $A_1(1, -1, 1), A_2(-2, 0, 3), A_3(2, 1, -1), A_4(2, -2, -4).$

8.21. $A_1(1, 2, 0), A_2(1, -1, 2), A_3(0, 1, -1), A_4(-3, 0, 1).$

8.22. $A_1(1, 0, 2), A_2(1, 2, -1), A_3(2, -2, 1), A_4(2, 1, 0).$

8.23. $A_1(1, 2, -3), A_2(1, 0, 1), A_3(-2, -1, 6), A_4(0, -5, -4).$

8.24. $A_1(3, 10, -1), A_2(-2, 3, -5), A_3(-6, 0, -3), A_4(1, -1, 2).$

8.25. $A_1(-1, 2, 4), A_2(-1, -2, -4), A_3(3, 0, -1), A_4(7, -3, 1).$

8.26. $A_1(0, -3, 1), A_2(-4, 1, 2), A_3(2, -1, 5), A_4(3, 1, -4).$

8.27. $A_1(1, 3, 0), A_2(4, -1, 2), A_3(3, 0, 1), A_4(-4, 3, 5).$

8.28. $A_1(-2, -1, -1), A_2(0, 3, 2), A_3(3, 1, -4), A_4(-4, 7, 3).$

8.29. $A_1(-3, -5, 6), A_2(2, 1, -4), A_3(0, -3, -1), A_4(-5, 2, -8).$

8.30. $A_1(2, -4, -3), A_2(5, -6, 0), A_3(-1, 3, -3), A_4(-10, -8, 7).$