

B_P_2.1 Vektoren (Lösungen)

Lösungen Maturaufgaben:

- 1) Gehe zum Aufgabenpool Mathematik BHS: <https://prod.aufgabenpool.at/amn/index.php?id=AM>
- 2) Gib im Feld „**Titel-/ID-Suche**“ die **Nummer** ein. Du kommst zur zugehörigen Aufgabe. Die Lösungen sind bei der Aufgabe enthalten.

Deskriptor

Schlagwortsuche

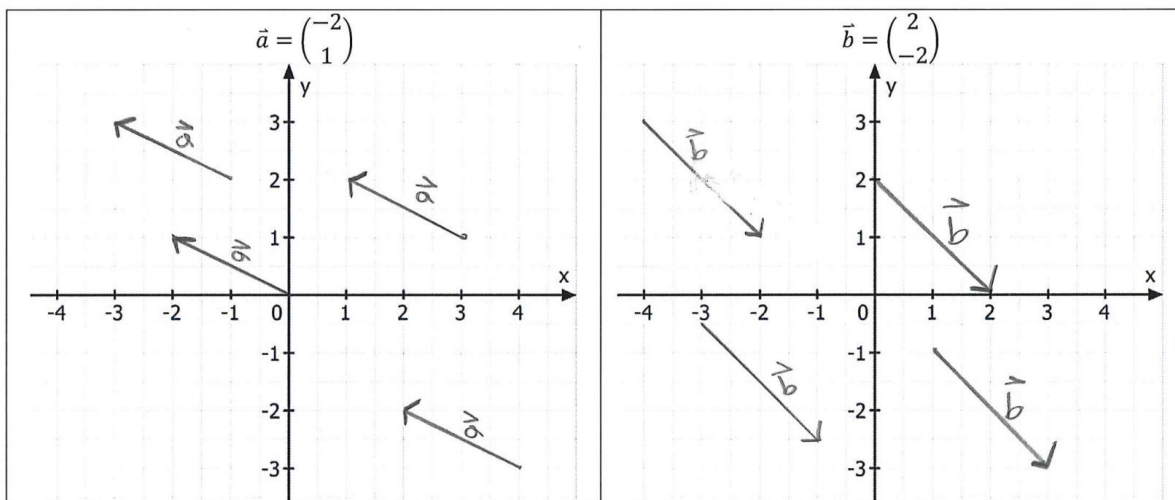
Aufgabentyp ▾

Titel-/ ID-Suche

Baseball * (A_237)

↑
Nummer

Bsp. 1)



Bsp. 2)

$\vec{a} = \begin{pmatrix} -2 \\ 5 \end{pmatrix} \rightarrow -\vec{a} = \begin{pmatrix} 2 \\ -5 \end{pmatrix}$	$\vec{b} = \begin{pmatrix} 12 \\ -3 \end{pmatrix} \rightarrow -\vec{b} = \begin{pmatrix} -12 \\ 3 \end{pmatrix}$	$\vec{c} = \begin{pmatrix} -14 \\ -14 \end{pmatrix} \rightarrow -\vec{c} = \begin{pmatrix} 14 \\ 14 \end{pmatrix}$
$\vec{d} = \begin{pmatrix} 8 \\ 9 \end{pmatrix} \rightarrow -\vec{d} = \begin{pmatrix} -8 \\ -9 \end{pmatrix}$	$\vec{e} = \begin{pmatrix} -4 \\ -4 \end{pmatrix} \rightarrow -\vec{e} = \begin{pmatrix} 4 \\ 4 \end{pmatrix}$	$\vec{f} = \begin{pmatrix} 102 \\ -103 \end{pmatrix} \rightarrow -\vec{f} = \begin{pmatrix} -102 \\ 103 \end{pmatrix}$

Bsp. 3)

$\vec{a} + \vec{b} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} + \begin{pmatrix} -3 \\ -2 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$	$\vec{a} - \vec{c} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} - \begin{pmatrix} 13 \\ -12 \end{pmatrix}$	$\vec{b} + \vec{e} = \begin{pmatrix} -7 \\ -6 \end{pmatrix}$
$\vec{d} - \vec{a} = \begin{pmatrix} -7 \\ 6 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} -10 \\ 4 \end{pmatrix}$	$\vec{b} - \vec{d} = \begin{pmatrix} -3 \\ -2 \end{pmatrix} - \begin{pmatrix} -7 \\ 6 \end{pmatrix} = \begin{pmatrix} -4 \\ -8 \end{pmatrix}$	$\vec{c} - \vec{d} = \begin{pmatrix} 20 \\ -18 \end{pmatrix}$
$\vec{e} - \vec{a} = \begin{pmatrix} -4 \\ -4 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} -7 \\ -6 \end{pmatrix}$	$\vec{c} + \vec{a} = \begin{pmatrix} 16 \\ -10 \end{pmatrix}$	$\vec{b} - \vec{a} = \begin{pmatrix} -6 \\ -4 \end{pmatrix}$

Bsp. 4)

$\vec{a} + \vec{b} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} + \begin{pmatrix} -1 \\ -5 \\ -2 \end{pmatrix} = \begin{pmatrix} 0 \\ -3 \\ 1 \end{pmatrix}$	$\vec{a} - \vec{c} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} - \begin{pmatrix} 2 \\ 7 \\ 8 \end{pmatrix} = \begin{pmatrix} -1 \\ -5 \\ -5 \end{pmatrix}$	$\vec{b} + \vec{e} = \begin{pmatrix} 2 \\ 5 \\ 7 \end{pmatrix}$
$\vec{d} - \vec{a} = \begin{pmatrix} -12 \\ 20 \\ -16 \end{pmatrix}$	$\vec{b} - \vec{d} = \begin{pmatrix} 10 \\ -27 \\ 10 \end{pmatrix}$	$\vec{c} - \vec{d} = \begin{pmatrix} 14 \\ -15 \\ 19 \end{pmatrix}$
$\vec{e} - \vec{a} = \begin{pmatrix} 9 \\ 3 \\ 7 \end{pmatrix}$	$\vec{c} + \vec{a} = \begin{pmatrix} 4 \\ 9 \\ 9 \end{pmatrix}$	$\vec{b} - \vec{a} = \begin{pmatrix} -2 \\ 7 \\ -6 \end{pmatrix}$

Bsp. 5)

$2 \cdot \vec{a} = 2 \cdot \begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$	$-3 \cdot \vec{a} = \begin{pmatrix} -9 \\ -4 \end{pmatrix}$	$10 \cdot \vec{a} = \begin{pmatrix} 30 \\ 20 \end{pmatrix}$
$4 \cdot \vec{b} = 4 \cdot \begin{pmatrix} -1 \\ -5 \\ -3 \\ 2 \end{pmatrix} = \begin{pmatrix} -4 \\ -20 \\ -12 \\ 8 \end{pmatrix}$	$-0,5 \cdot \vec{b} = \begin{pmatrix} 0,5 \\ 2,5 \\ 1,5 \\ -1 \end{pmatrix}$	$100 \cdot \vec{b} = \begin{pmatrix} -100 \\ -500 \\ -300 \\ 200 \end{pmatrix}$
$0,1 \cdot \vec{c} = 0,1 \cdot \begin{pmatrix} 3 \\ 7 \\ 0 \end{pmatrix} = \begin{pmatrix} 0,3 \\ 0,7 \\ 0,6 \end{pmatrix}$	$1,5 \cdot \vec{c} = \begin{pmatrix} 4,5 \\ 10,5 \\ 9 \end{pmatrix}$	$5 \cdot \vec{c} = \begin{pmatrix} 15 \\ 35 \\ 30 \end{pmatrix}$

Bsp. 6)

$\vec{a} \cdot \vec{b} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} \cdot \begin{pmatrix} -3 \\ -2 \end{pmatrix} = 9 - 4 = \underline{-13}$	$\vec{a} \cdot \vec{c} = 3 \cdot 13 + 2 \cdot (-12) = 39 - 24 = \underline{15}$	$\vec{b} \cdot \vec{e} = (-3) \cdot (-9) + (-2) \cdot (-9) = 27 + 18 = \underline{45}$
$\vec{d} \cdot \vec{a} = \begin{pmatrix} -7 \\ 6 \end{pmatrix} \cdot \begin{pmatrix} 3 \\ 2 \end{pmatrix} = -21 + 12 = \underline{-9}$	$\vec{b} \cdot \vec{d} = (-3) \cdot (-7) + (-2) \cdot 6 = 21 - 12 = \underline{9}$	$\vec{c} \cdot \vec{d} = 13 \cdot (-7) + (-12) \cdot 6 = -91 - 72 = \underline{-163}$

Bsp. 7)

$$\vec{a} \cdot \vec{b} = 2 - 10 + 18 + 4 = \underline{14}$$

Bsp. 8)

$\overline{AB} = B - A = \begin{pmatrix} -3 \\ -2 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} -6 \\ -4 \end{pmatrix}$	$\overline{AD} = D - A = \begin{pmatrix} -10 \\ -4 \end{pmatrix}$	$\overline{EC} = C - E = \begin{pmatrix} 17 \\ 8 \end{pmatrix}$
$\overline{CD} = D - C = \begin{pmatrix} -20 \\ 18 \end{pmatrix}$	$\overline{BE} = E - B = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$	$\overline{DB} = B - D = \begin{pmatrix} 4 \\ 8 \end{pmatrix}$

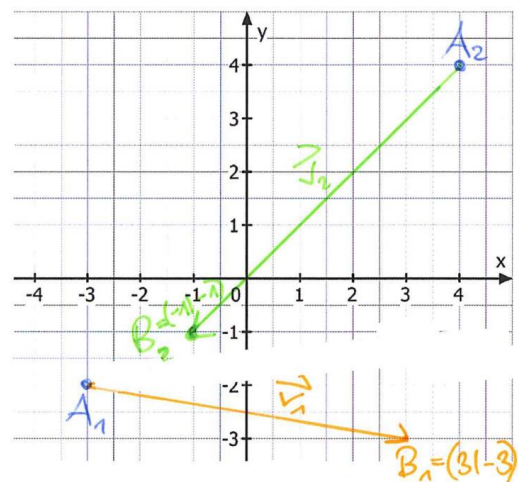
Bsp. 9)

$ \overline{AB} = \overrightarrow{AB} = B - A = \begin{pmatrix} 4 \\ 4 \end{pmatrix}$ $\Rightarrow \overline{AB} = \sqrt{4^2 + 4^2} \approx \underline{4,1}$	$ \overline{AD} =$ ① $\overrightarrow{AD} = D - A = \begin{pmatrix} -4 \\ -4 \end{pmatrix}$ ② $ \overline{AD} = \sqrt{(-4)^2 + (-4)^2} = \sqrt{17} \approx \underline{4,1}$	$ \overline{EC} =$ ① $\overrightarrow{EC} = C - E = \begin{pmatrix} -15 \\ -21 \end{pmatrix}$ ② $ \overline{EC} = \sqrt{(-15)^2 + (-21)^2} \approx \underline{25,8}$
$ \overline{CD} =$ ① $\overrightarrow{CD} = D - C = \begin{pmatrix} 2 \\ -13 \end{pmatrix}$ ② $ \overline{CD} = \sqrt{2^2 + (-13)^2} \approx \underline{13,2}$	$ \overline{BE} =$ ① $\overrightarrow{BE} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$ ② $ \overline{BE} \approx \underline{2,4,8}$	$ \overline{DB} =$ ① $\overrightarrow{DB} = \begin{pmatrix} 3 \\ 8 \end{pmatrix}$ ② $ \overline{DB} = \sqrt{4 + 64} \approx \underline{8,2}$

Bsp. 10)

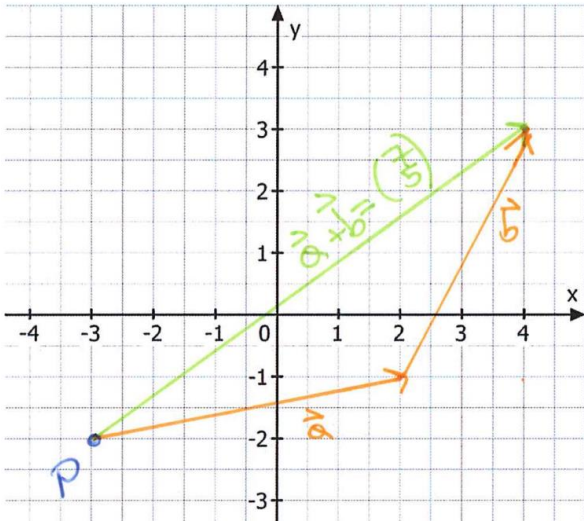
Bsp. 11) Addiere die Vektoren geometrisch als **Addition von Punkt und Pfeil**. Gib die Koordinaten des Endpunktes an B_1 bzw. B_2 an. Kontrolliere rechnerisch.

a. $A_1 = (-3 -2), \vec{v}_1 = \begin{pmatrix} 6 \\ -1 \end{pmatrix}$ $A_1 + \vec{v}_1 =$ $\begin{pmatrix} -3 \\ -2 \end{pmatrix} + \begin{pmatrix} 6 \\ -1 \end{pmatrix} = \underline{\underline{\begin{pmatrix} 3 \\ -3 \end{pmatrix}}}$	b. $A_2 = (4 4), \vec{v}_2 = \begin{pmatrix} -5 \\ -3 \end{pmatrix}$ $A_2 + \vec{v}_2 =$ $\begin{pmatrix} 4 \\ 4 \end{pmatrix} + \begin{pmatrix} -5 \\ -3 \end{pmatrix} = \underline{\underline{\begin{pmatrix} -1 \\ -1 \end{pmatrix}}}$
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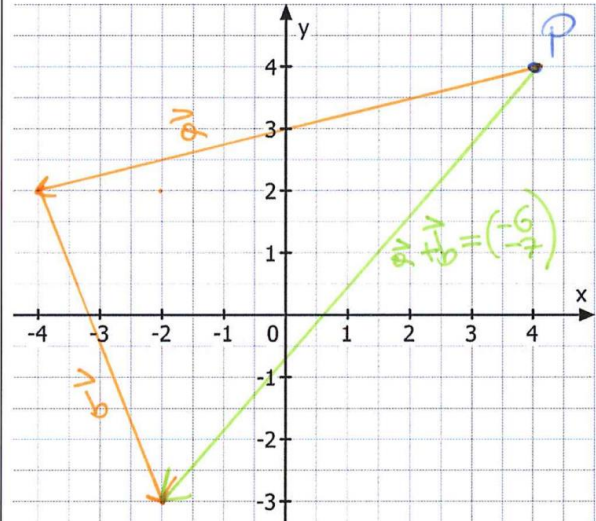


Bsp. 11)

$$P = (-3|-2), \vec{a} = \begin{pmatrix} 5 \\ 1 \end{pmatrix}, \vec{b} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}, \vec{v} = ?$$

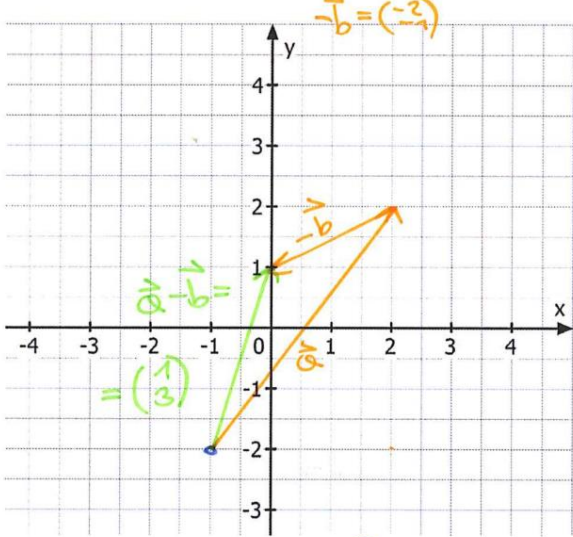


$$P = (4|4), \vec{a} = \begin{pmatrix} -8 \\ -2 \end{pmatrix}, \vec{b} = \begin{pmatrix} 2 \\ -5 \end{pmatrix}, \vec{v} = ?$$



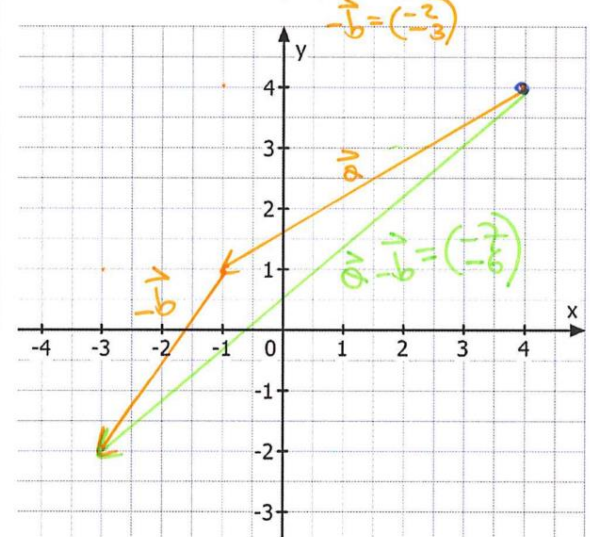
Bsp. 12)

$$P = (-1|-2), \vec{a} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}, \vec{b} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}, \vec{v} = ?$$



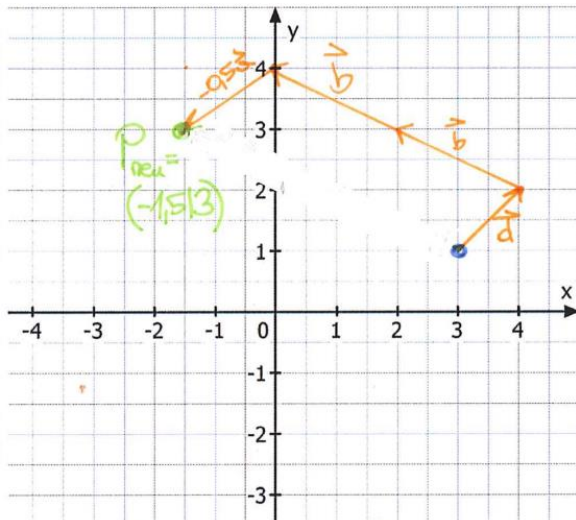
$$\vec{v} = \vec{a} - \vec{b} = \begin{pmatrix} 3 \\ 4 \end{pmatrix} - \begin{pmatrix} 2 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 3 \end{pmatrix} \checkmark$$

$$P = (4|4), \vec{a} = \begin{pmatrix} -5 \\ -3 \end{pmatrix}, \vec{b} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}, \vec{v} = ?$$

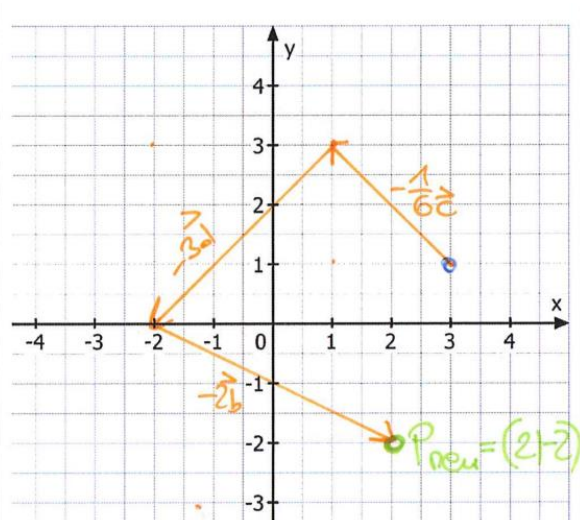


$$\vec{v} = \vec{a} - \vec{b} = \begin{pmatrix} -5 \\ -3 \end{pmatrix} - \begin{pmatrix} 2 \\ 3 \end{pmatrix} = \begin{pmatrix} -7 \\ -6 \end{pmatrix} \checkmark$$

Bsp. 13)

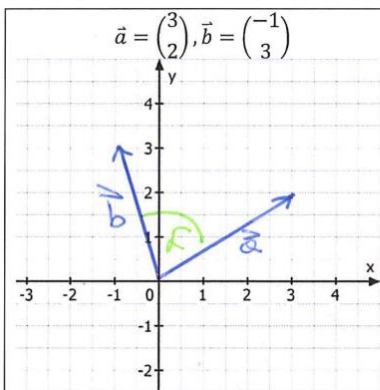


$$\begin{aligned}
 P_{neu} &= \begin{pmatrix} 3 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \end{pmatrix} + 2 \cdot \begin{pmatrix} -2 \\ 1 \end{pmatrix} - 0,5 \cdot \begin{pmatrix} 3 \\ 2 \end{pmatrix} \\
 &= \begin{pmatrix} 3 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \end{pmatrix} + \begin{pmatrix} -4 \\ 2 \end{pmatrix} + \begin{pmatrix} -1,5 \\ -1 \end{pmatrix} = \\
 &= \begin{pmatrix} -1,5 \\ 3 \end{pmatrix} = \underline{\underline{(-1,5 | 3)}} \checkmark
 \end{aligned}$$

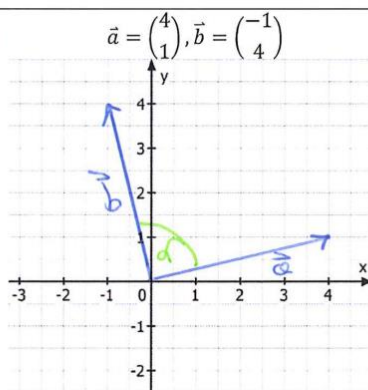


$$\begin{aligned}
 P_{neu} &= \begin{pmatrix} 3 \\ 1 \end{pmatrix} - \frac{1}{6} \cdot \begin{pmatrix} 12 \\ -12 \end{pmatrix} - 3 \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} - 2 \cdot \begin{pmatrix} -2 \\ 1 \end{pmatrix} \\
 &= \begin{pmatrix} 3 \\ 1 \end{pmatrix} + \begin{pmatrix} -2 \\ 2 \end{pmatrix} + \begin{pmatrix} -3 \\ -3 \end{pmatrix} + \begin{pmatrix} 4 \\ -2 \end{pmatrix} \\
 &= \begin{pmatrix} 2 \\ -2 \end{pmatrix} = \underline{\underline{(2 | -2)}}
 \end{aligned}$$

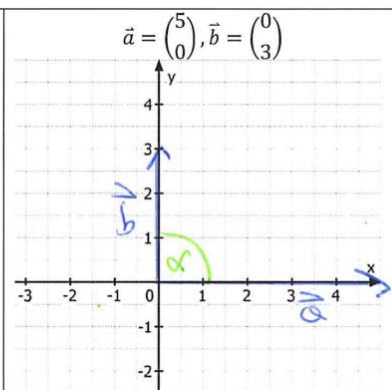
Bsp. 14)



$$\begin{aligned}
 \cos(\alpha) &= \frac{\vec{a} \cdot \vec{b}}{|\vec{a}| \cdot |\vec{b}|} = \frac{-3+6}{\sqrt{13} \cdot \sqrt{10}} \\
 \Rightarrow \alpha &= \cos^{-1}\left(\frac{3}{\sqrt{130}}\right) \\
 \alpha &\approx \underline{\underline{74,7^\circ}}
 \end{aligned}$$



$$\begin{aligned}
 \alpha &= \cos^{-1}\left(\frac{\vec{a} \cdot \vec{b}}{|\vec{a}| \cdot |\vec{b}|}\right) \\
 \alpha &= \cos^{-1}\left(\frac{0}{\sqrt{17} \cdot \sqrt{17}}\right) \\
 \alpha &= \underline{\underline{90^\circ}}
 \end{aligned}$$

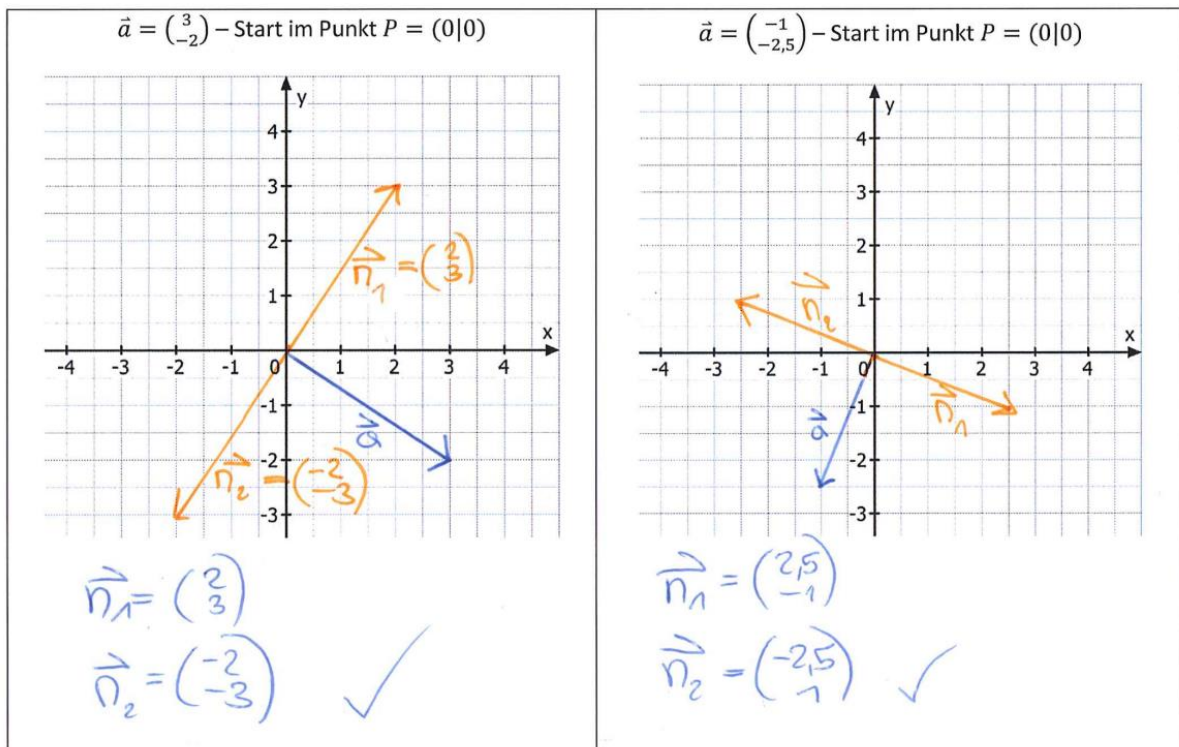


$$\begin{aligned}
 \alpha &= \cos^{-1}\left(\frac{\vec{a} \cdot \vec{b}}{|\vec{a}| \cdot |\vec{b}|}\right) \\
 \alpha &= \cos^{-1}\left(\frac{0}{\sqrt{25} \cdot \sqrt{9}}\right) \\
 \alpha &= \underline{\underline{90^\circ}}
 \end{aligned}$$

Bsp. 15)

$\vec{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ $\vec{n}_1 = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ $\vec{n}_2 = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$	$\vec{b} = \begin{pmatrix} -3,5 \\ -12 \end{pmatrix}$ $\vec{m}_1 = \begin{pmatrix} 12 \\ -3,5 \end{pmatrix}$ $\vec{n}_2 = \begin{pmatrix} -12 \\ 3,5 \end{pmatrix}$	$\vec{c} = \begin{pmatrix} -3 \\ 30 \end{pmatrix}$ $\vec{n}_1 = \begin{pmatrix} -30 \\ -3 \end{pmatrix}$ $\vec{n}_2 = \begin{pmatrix} 30 \\ 3 \end{pmatrix}$
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Bsp. 16)



Bsp. 17)

$\vec{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}, \vec{b} = \begin{pmatrix} 6 \\ -10 \end{pmatrix}$ $\vec{a} \cdot \vec{b} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} \cdot \begin{pmatrix} 6 \\ -10 \end{pmatrix}$ $= 18 - 20 = -2 \neq 0$ NEIN! $\vec{a} \not\perp \vec{b}$	$\vec{a} = \begin{pmatrix} 7 \\ 2 \end{pmatrix}, \vec{b} = \begin{pmatrix} -6 \\ 21 \end{pmatrix}$ $\begin{pmatrix} 7 \\ 2 \end{pmatrix} \cdot \begin{pmatrix} -6 \\ 21 \end{pmatrix} = -42 + 42 = 0$ $\vec{a} \perp \vec{b}$	$\vec{a} = \begin{pmatrix} 100 \\ -15 \end{pmatrix}, \vec{b} = \begin{pmatrix} -3 \\ -20 \end{pmatrix}$ $\begin{pmatrix} 100 \\ -15 \end{pmatrix} \cdot \begin{pmatrix} -3 \\ -20 \end{pmatrix} =$ $= -300 + 300 = 0$ $\vec{a} \perp \vec{b}$
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Bsp. 18)

$\vec{a} = \begin{pmatrix} -4 \\ 2 \end{pmatrix}, \vec{b} = \begin{pmatrix} b_1 \\ 8 \end{pmatrix}$ $\vec{a} \cdot \vec{b} = 0$ $\begin{pmatrix} -4 \\ 2 \end{pmatrix} \cdot \begin{pmatrix} b_1 \\ 8 \end{pmatrix} = 0$ $-4b_1 + 16 = 0 \quad -16$ $-4b_1 = -16 \quad :(-4)$ $\underline{\underline{b_1 = 4}}$	$\vec{a} = \begin{pmatrix} 5 \\ a_2 \end{pmatrix}, \vec{b} = \begin{pmatrix} 20 \\ -10 \end{pmatrix}$ $\vec{a} \cdot \vec{b} = 0$ $\begin{pmatrix} 5 \\ a_2 \end{pmatrix} \cdot \begin{pmatrix} 20 \\ -10 \end{pmatrix} = 0$ $100 - 10a_2 = 0 \quad -100$ $-10a_2 = -100 \quad :(-10)$ $\underline{\underline{a_2 = 10}}$	$\vec{a} = \begin{pmatrix} a_1 \\ -8 \end{pmatrix}, \vec{b} = \begin{pmatrix} -2 \\ 8 \end{pmatrix}$ $\vec{a} \cdot \vec{b} = 0$ $-2 \cdot a_1 - 64 = 0 \quad +64$ $-2a_1 = 64 \quad :(-2)$ $\underline{\underline{a_1 = -32}}$
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Bsp. 19)

$\vec{a} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ $ \vec{a} = \sqrt{9+16} = \sqrt{25} = 5$ $\Rightarrow \vec{a}_0 = \frac{1}{5} \cdot \begin{pmatrix} 3 \\ 4 \end{pmatrix}$	$\vec{b} = \begin{pmatrix} 7 \\ -3 \end{pmatrix}$ $ \vec{b} = \sqrt{49+9} = \sqrt{58}$ $\vec{b}_0 = \frac{1}{\sqrt{58}} \cdot \begin{pmatrix} 7 \\ -3 \end{pmatrix}$	$\vec{c} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$ $ \vec{c} = \sqrt{5}$ $\vec{c}_0 = \frac{1}{\sqrt{5}} \cdot \begin{pmatrix} -1 \\ -2 \end{pmatrix}$
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Bsp. 20)

$\vec{a} = \begin{pmatrix} 5 \\ 4 \end{pmatrix}, l = 2$ $\textcircled{1} \vec{a} = \sqrt{25+16} = \sqrt{41}$ $\textcircled{2} \vec{a}_0 = \frac{1}{\sqrt{41}} \cdot \begin{pmatrix} 5 \\ 4 \end{pmatrix}$ $\Rightarrow \vec{b} = 2 \cdot \vec{a}_0 = \underline{\underline{2 \cdot \frac{1}{\sqrt{41}} \cdot \begin{pmatrix} 5 \\ 4 \end{pmatrix}}}$	$\vec{a} = \begin{pmatrix} -1 \\ 10 \end{pmatrix}, l = 10$ $\textcircled{1} \vec{a} = \sqrt{101}$ $\textcircled{2} \vec{a}_0 = \frac{1}{\sqrt{101}} \cdot \begin{pmatrix} -1 \\ 10 \end{pmatrix}$ $\Rightarrow \vec{b} = \underline{\underline{\frac{10}{\sqrt{101}} \cdot \begin{pmatrix} -1 \\ 10 \end{pmatrix}}}$
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Bsp. 21)

$A = (-2 -3), B = (2 0), l = 5$ $\vec{a} = \overrightarrow{AB} = B - A = \begin{pmatrix} 4 \\ 3 \end{pmatrix}, \vec{a} = 5$ $\Rightarrow \vec{a}_0 = \frac{1}{5} \cdot \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ $R = B + 5 \cdot \vec{a}_0 = \begin{pmatrix} 2 \\ 0 \end{pmatrix} + \frac{5}{5} \cdot \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ $= \begin{pmatrix} 2 \\ 0 \end{pmatrix} + \begin{pmatrix} 4 \\ 3 \end{pmatrix} = \underline{\underline{\begin{pmatrix} 6 \\ 3 \end{pmatrix}}}$	$A = (-4 -3), B = (1 5), l = 6$ $\vec{a}_0 = \overrightarrow{AB} = B - A = \begin{pmatrix} 5 \\ 8 \end{pmatrix}, \vec{a} = \sqrt{89}$ $\Rightarrow \vec{a}_0 = \frac{1}{\sqrt{89}} \cdot \begin{pmatrix} 5 \\ 8 \end{pmatrix}$ $R = B + 6 \cdot \vec{a}_0 = \begin{pmatrix} 1 \\ 5 \end{pmatrix} + 6 \cdot \frac{1}{\sqrt{89}} \cdot \begin{pmatrix} 5 \\ 8 \end{pmatrix}$ $= \begin{pmatrix} 1 \\ 5 \end{pmatrix} + 0,64 \cdot \begin{pmatrix} 5 \\ 8 \end{pmatrix} = \underline{\underline{\begin{pmatrix} 4,18 \\ 10,09 \end{pmatrix}}}$
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Bsp. 22)