


النموذج (د)

①

1-

(d)  $\pi$  


2-


(c)  $\tan \theta$  

3-

Angenommen:

$x^4$  be  $T_{r+1}$

$$T_{r+1} = {}^{12}C_r \left(\frac{-1}{x^2}\right)^r (x^2)^{12-r}$$


$$= {}^{12}C_r (-1)^r x^{24-4r}$$


$$24 - 4r = 4 \Rightarrow r = 5$$


$\therefore$  der Term mit

$x^4$  is  $T_6$  

$$T_6 = {}^{12}C_5 (-1)^5 (x^4) = -792x^4$$


• die Ordnung des mittleren Term ist

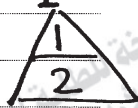
$$\therefore \frac{12}{2} + 1 = 7$$

$$T_7 = {}^{12}C_6 \times \left(\frac{-1}{x^2}\right)^6 \times (x^2)^6 = {}^{12}C_6 = 924$$


$$\therefore \frac{\text{Koeff. von } T_6}{\text{Koeff. von } T_7} = \frac{-792}{924} = \frac{-6}{7}$$


$$\frac{\text{Koeff. von } T_6}{\text{Koeff. von } T_7} = \frac{r}{n-r+1} \times \frac{1^{\text{st}}}{2^{\text{nd}}}$$

$$= \frac{6}{12-6+1} \times \frac{1}{-1}$$


$$= \frac{-6}{7}$$


4-

$$\vec{n} \cdot \vec{r} = \vec{n} \cdot \vec{A}$$

$$(4, 10, -7) \cdot \vec{r} = (4, 10, -7) \cdot (2, -1, 0)$$

$$(4, 10, -7) \cdot \vec{r} = -2$$

$$4(x-2) + 10(y+1) - 7z = 0$$

$$4x + 10y - 7z + 2 = 0$$

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5-

$$(b) \quad (1, 1) \quad \triangle 1$$

6-

Die Gerade bildet gleiche Winkel mit den positiven Richtungen der Koordinatenachsen

$$\therefore \cos \theta_x = \cos \theta_y = \cos \theta_z$$

$$\therefore \cos^2 \theta_x + \cos^2 \theta_y + \cos^2 \theta_z = 1$$

$$\therefore \cos^2 \theta_x = \cos^2 \theta_y = \cos^2 \theta_z = \frac{1}{3}$$

$$\therefore \cos \theta_x = \cos \theta_y = \cos \theta_z = \pm \frac{1}{\sqrt{3}} \quad \triangle 1$$

$$= \left( \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}} \right) \quad \triangle 2$$

Der Richtungsvektor der Geraden Die  
vektorielle Form Die parametrischen  
Gleichungen Die kartesische Gleichung

$$\therefore \vec{r} = (3, 2, -1) + t \left( \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}} \right) \quad \triangle 1$$

$$\therefore r = (3, 2, -1) + t (1, 1, 1) \quad \triangle 2$$

$$\bullet \quad x = 3 + t, \quad y = 2 + t, \quad z = -1 + t$$

$$x = 3 + \frac{1}{\sqrt{3}}t, \quad y = 2 + \frac{1}{\sqrt{3}}t, \quad z = -1 + \frac{1}{\sqrt{3}}t \quad \triangle 1$$

$$\bullet \quad x - 3 = y - 2 = z + 1 \quad \triangle 1$$

$$\frac{x-3}{\left(\frac{1}{\sqrt{3}}\right)} = \frac{y-2}{\left(\frac{1}{\sqrt{3}}\right)} = \frac{z+1}{\left(\frac{1}{\sqrt{3}}\right)} \quad \triangle 2$$

7-

$$\begin{pmatrix} 0 & -3 & 2 \\ 5 & 1 & 0 \\ 1 & -2 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 7 \\ 4 \\ 1 \end{pmatrix}$$

$$AX = B$$

$$|A| = \begin{vmatrix} 0 & -3 & 2 \\ 5 & 1 & 0 \\ 1 & -2 & -1 \end{vmatrix} = 3(-5) + 2(-11) = -37 \neq 0$$

$$\text{Adj}(A) = \begin{pmatrix} -1 & 5 & -11 \\ -7 & -2 & -3 \\ -2 & 10 & 15 \end{pmatrix}^t = \begin{pmatrix} -1 & -7 & -2 \\ 5 & -2 & 10 \\ -11 & -3 & 15 \end{pmatrix}$$

$$A^{-1} = \frac{1}{|A|} \text{Adj}(A)$$

$$\therefore A^{-1} = \frac{1}{-37} \begin{pmatrix} -1 & -7 & -2 \\ 5 & -2 & 10 \\ -11 & -3 & 15 \end{pmatrix}$$

$$\therefore \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \frac{1}{-37} \begin{pmatrix} -1 & -7 & -2 \\ 5 & -2 & 10 \\ -11 & -3 & 15 \end{pmatrix} \begin{pmatrix} 7 \\ 4 \\ 1 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \frac{-1}{37} \begin{pmatrix} -37 \\ 37 \\ -74 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ -1 \\ 2 \end{pmatrix}$$

$$\therefore x = 1, y = -1, z = 2$$

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8-

$$(b) {}^3C_1 \times {}^9C_3$$



9-

$$(b) 2 \cos \theta$$



10-

$$(d) \vec{r} = (2, 1, -3) + k(-1, 1, -2)$$



11-

$$\textcircled{a} \quad Z = \frac{8(\sqrt{3}+i)}{(\sqrt{3}-i)} \times \frac{\sqrt{3}+i}{\sqrt{3}+i}$$

$$Z = \frac{8(3+2\sqrt{3}i-1)}{4}$$

$$\frac{1}{2}$$

$$Z = 8 \left( \frac{1}{2} + \frac{\sqrt{3}}{2} i \right) = 8 \left( \cos \frac{\pi}{3} + i \sin \frac{\pi}{3} \right)$$

$$Z = 8 e^{\frac{\pi}{3}i}$$

$$\frac{1}{2}$$

$$\sqrt[3]{Z} = 2 e^{\frac{\pi+2\pi n}{3}i}, \quad i = 0, 1, -1$$

$$\frac{1}{2}$$

$$n=0 \quad \therefore \sqrt[3]{Z} = 2 e^{\frac{\pi}{3}i}$$

$$\frac{1}{2}$$

$$n=1 \quad \therefore \sqrt[3]{Z} = 2 e^{\frac{3\pi}{3}i}$$

$$\frac{1}{2}$$

$$n=-1 \quad \therefore \sqrt[3]{Z} = 2 e^{-\frac{5\pi}{3}i}$$

$$\frac{1}{2}$$

$$\textcircled{b} \quad (x+yi)(1-3i) = 37 \frac{(7+4\omega^2+3-4\omega^2)}{(3-4\omega^2)(7+4\omega^2)}$$

$$\frac{1}{2}$$

$$= 37 \frac{10}{(3-4\omega^2)(7+4\omega^2)}$$

$$= 37 \frac{10}{21-16\omega^2-16\omega}$$

$$\frac{1}{2}$$

$$= 37 \frac{10}{21-16(\omega^2+\omega)} = \frac{370}{37} = 10$$

$$\frac{1}{2}$$

$$\therefore x+yi = \frac{10}{1-3i} \times \frac{1+3i}{1+3i} = \frac{10(1+3i)}{10}$$

$$\frac{1}{2}$$

$$x+yi = 1+3i \quad \Rightarrow \quad x=1 \text{ und } y=3$$

$$\frac{1}{2}$$

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12-

(b) 15



13-

(c)  $(x-2)^2 + (y+3)^2 + (z-4)^2 = 16$



14-

(b)  $z = 5$



15-

$$\text{a) } \vec{BA} = \vec{A} - \vec{B} = (-1, -2, -3)$$

$$\vec{BC} = \vec{C} - \vec{B} = (-1, 4, 0)$$

$$\text{(i) } \cos(\angle ABC) = \frac{\vec{BA} \cdot \vec{BC}}{\|\vec{BA}\| \|\vec{BC}\|}$$

$$= \frac{(-1, -2, -3) \cdot (-1, 4, 0)}{\sqrt{1+4+9} \sqrt{1+16+0}}$$

$$= \frac{1-8+0}{\sqrt{14} \sqrt{17}} = \frac{-7}{\sqrt{14} \sqrt{17}}$$

$$\therefore m(\angle ABC) \approx 117^\circ$$

$$\text{(ii) } \therefore \vec{BC} = \vec{C} - \vec{B} \Rightarrow \vec{C} = \vec{BC} + \vec{B}$$

$$\vec{C} = (-1, 4, 0) + (3, 5, 4) = (2, 9, 4)$$

$$\therefore \vec{AC} = \vec{C} - \vec{A} = (0, 6, 3)$$

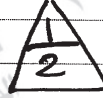
Die Richtungskomponente  $= \left( \frac{\vec{AC} \cdot \vec{AB}}{\|\vec{AB}\|^2} \right) \cdot \vec{AB}$

$$= \frac{(0, 6, 3) \cdot (1, 2, 3)}{1+4+9} \cdot (1, 2, 3)$$

$$= \frac{0+12+9}{14} \cdot (1, 2, 3) = \left( \frac{3}{2}, 3, \frac{9}{2} \right)$$

b) Das Volumen des Parallelepipeds

$$= | \vec{A} \cdot \vec{B} \times \vec{C} |$$



$$= \begin{vmatrix} 1 & 4 & 2 \\ -3 & 2 & 1 \\ -1 & 1 & 4 \end{vmatrix}$$

$$= 1(7) - 4(-11) + 2(-1) = 49$$



(ii) Die Basisfläche =  $\| \vec{A} \times \vec{B} \|$

$$\therefore \vec{A} \times \vec{B} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 1 & 4 & 2 \\ -3 & 2 & 1 \end{vmatrix} = -7\vec{j} + 14\vec{k}$$

$$\therefore \| \vec{A} \times \vec{B} \| = \sqrt{(-7)^2 + (14)^2} = 7\sqrt{5}$$



Die Basisfläche =  $7\sqrt{5}$

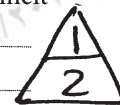
Flächeneinheit

Die Höhe des Parallelepipeds =  $\frac{\text{Volumen}}{\text{Basisfläche}}$

$$= \frac{49}{7\sqrt{5}} = \frac{7\sqrt{5}}{5}$$

Längeneinheit

$$\approx 3.13 \text{ Längeneinheit}$$



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16-

(b) 15



17-

(a) 10



18-

(b) 2



19-

$$\begin{array}{ccc|c} 1 & 1 & 1 & \\ \hline a & b & c & \\ \hline a^2 & b^2 & c^2 & \end{array} \begin{array}{l} C_2 - C_1 \\ C_3 - C_1 \end{array} \Rightarrow$$

$$= \begin{array}{ccc|c} 1 & 0 & 0 & \\ \hline a & b-a & c-a & \\ \hline a^2 & b^2-a^2 & c^2-a^2 & \end{array} \begin{array}{l} \triangle \\ 1 \end{array}$$

$$= \begin{array}{ccc|c} 1 & 0 & 0 & \\ \hline a & (b-a) & (c-a) & \\ \hline a^2 & (b-a)(b+a) & (c-a)(c+a) & \end{array} \begin{array}{l} \triangle \\ \frac{1}{2} \end{array}$$

$$= (b-a)(c-a) \begin{array}{ccc|c} 1 & 0 & 0 & \\ \hline a & 1 & 1 & \\ \hline a^2 & b+a & c+a & \end{array} \begin{array}{l} \triangle \\ \frac{1}{2} \end{array} \begin{array}{l} C_3 - C_2 \\ \Rightarrow \end{array}$$

$$= (b-a)(c-a) \begin{array}{ccc|c} 1 & 0 & 0 & \\ \hline a & 1 & 0 & \\ \hline a^2 & b+a & c-b & \end{array} \begin{array}{l} \triangle \\ \frac{1}{2} \end{array}$$

$$= (b-a)(c-a)(c-b) \begin{array}{l} \triangle \\ \frac{1}{2} \end{array}$$

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