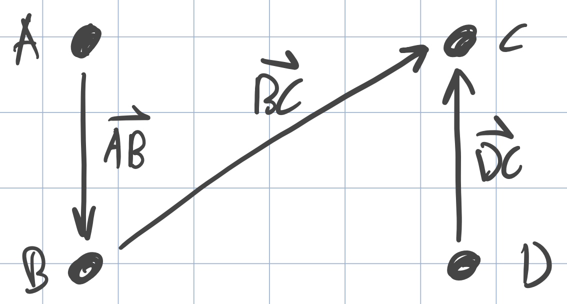
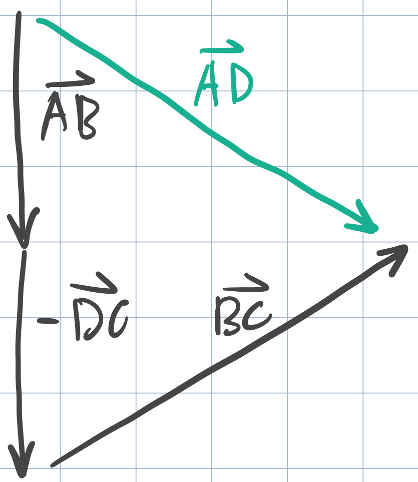
Given vectors $\overrightarrow{AB}$, $\overrightarrow{DC}$, and $\overrightarrow{BC}$, simplify $\overrightarrow{AB} - \overrightarrow{DC} + \overrightarrow{BC}$.

- ○ $\overrightarrow{BD}$
- ○ $\overrightarrow{AB}$
- ○ $\overrightarrow{BC}$
- ○ $\overrightarrow{AC}$
- ○ $\overrightarrow{AD}$



$$\overrightarrow{AB} - \overrightarrow{DC} + \overrightarrow{BC}$$



Answer is $\overrightarrow{AD}$

Express the following vectors in the form $v_1\hat{i} + v_2\hat{j} + v_3\hat{k}$.

(a) the vector from $(-27, 7, 15)$ to $(3, 11, -12)$

(b) the sum of vector $\langle 1, 2, -3 \rangle$ and -7 times $\langle 11, 4, -12 \rangle$

(c) the vector obtained by subtracting $\langle 1, 2, -3 \rangle$ from -7 times $\langle 11, 4, -12 \rangle$

Part A

$$\langle 3, 11, -12 \rangle - \langle -27, 7, 15 \rangle = \langle 30, 4, -27 \rangle$$

Part B

$\langle 1,2,-3\rangle - 7\langle 11,4,-12\rangle$

$= \langle 1,2,-3\rangle + \langle -77,-28,84\rangle$

$= \langle -76,-26,81\rangle$

Part C

$-7\langle 11,4,-12\rangle - \langle 1,2,-3\rangle$

$= \langle -77,-28,84\rangle - \langle 1,2,-3\rangle$

$= \langle -78,-30,87\rangle$

Let $\vec{a} = \langle 2, -2, 8\rangle$, and $\vec{b} = \langle -5, -1, 6\rangle$, and $\vec{c} = \langle 7, 3, 15\rangle$.

Find $\|\vec{a} + \vec{b} - \vec{c}\|$.

$|\vec{a}+\vec{b}-\vec{c}| = |\langle -3,-3,14\rangle - \langle 7,3,15\rangle|$

$= |\langle -10,-6,-1\rangle|$

$= \sqrt{10^2+6^2+1^2}$

Let $\vec{a} = \langle 3, -3, 6\rangle$, and $\vec{b} = \langle -6, -1, 3\rangle$, and $\vec{c} = \langle 8, 4, 11\rangle$.

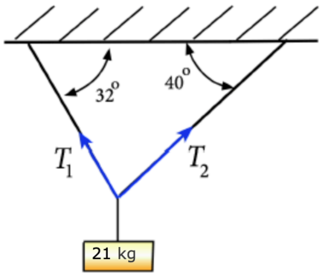
Find $\|2\vec{a} - 3\vec{b}\|$.

$|2\vec{a}-3\vec{b}| = |\langle 6,-6,12\rangle - \langle -18,-3,9\rangle|$

$$= |\langle 24, -3, 3 \rangle|$$

$$= \sqrt{24^2 + 3^2 + 3^2}$$

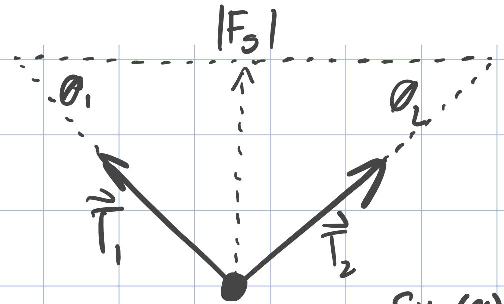
A 21 kg object is suspended from 2 cables as shown in the figure.



Find the magnitudes T_1 and T_2 of the tensions in the cables. Use g = 9.8 m/s^2 for the acceleration of gravity and give your answer correct to two decimal places.

T_1 = [ ] N

T_2 = [ ] N

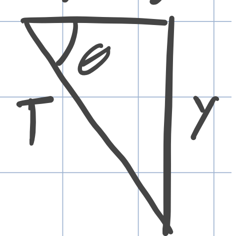


$$|\vec{F}_g| = mg$$

$$= 205.8 \text{ N}$$

$$\sin(\theta) = \frac{y}{T}$$

$$y = T\sin(\theta)$$



Y and x components

$$|\vec{F}_g| = |\vec{T}_1|\sin(\theta_1) + |\vec{T}_2|\sin(\theta_2)$$

$$0 = |\vec{T}_1|\cos(\theta_1) - |\vec{T}_2|\cos(\theta_2)$$

$$|\vec{T}_1|\cos(\theta_1) = |\vec{T}_2|\cos(\theta_2)$$

$$|\vec{T}_1| = \frac{|\vec{T}_2|\cos(\theta_2)}{\cos(\theta_1)}$$

$$|\vec{F}_g| = \frac{|\vec{T}_2|\cos(\theta_2)}{\cos(\theta_1)}\sin(\theta_1) + |\vec{T}_2|\sin(\theta_2)$$

$$|\vec{F}_g| = |\vec{T}_2|\left(\frac{\sin(\theta_1)\cos(\theta_2)}{\cos(\theta_1)} + \sin(\theta_2)\right)$$

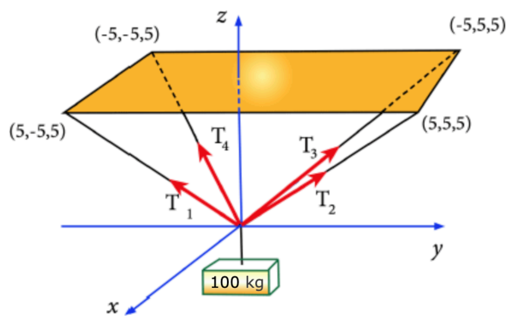
$$|\vec{F}_2| = \frac{|\vec{F}_3|}{\frac{\sin(\theta_1)\cos(\theta_2)}{\cos(\theta_1)} + \sin(\theta_2)}$$

$$= 183.510 \text{ N}$$

$$|\vec{T}_1| = \frac{|\vec{T}_2|\cos(\theta_2)}{\cos(\theta_1)}$$ From eariler

$$= 165.265 \text{ N}$$

A 100 kg object is suspended below the *xy*-plane by a short cable attached to a steel ring located at the origin (0, 0, 0) as shown below in the figure.



The ring itself is attached to 4 ropes which are attached to the ceiling, which is 5 meters above and parallel to the *xy*-plane. The ropes are attached to the ceiling at the points (−5, −5, 5), (5, −5, 5), (5, 5, 5), and (−5, 5, 5). Use symmetry to find the exact magnitudes T_1, T_2, T_3, and T_4 of the tensions in the cables, and use g = 9.8 m/s^2 for the acceleration of gravity.

T_1 = ______ N

T_2 = ______ N

T_3 = ______ N

T_4 = ______ N

$$\text{Let } T = |\vec{T}_1| = (\vec{T}_2) = |\vec{T}_3| = |\vec{T}_4|$$

$$T_x = \frac{5}{\sqrt{5^2+5^2+5^2}}$$

$$= \frac{5}{\sqrt{3\cdot 5^2}}$$

$$= \frac{5}{5\sqrt{3}}$$

$= \frac{1}{\sqrt{3}}$

$\hat{T} = \left\langle \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}} \right\rangle$

$|\vec{F}_g| = 980\ N$

$|\vec{F}_g| = 4T\ \hat{T}_z$

$T = \frac{|\vec{F}_g|}{4\frac{1}{\sqrt{3}}}$

$= \frac{|\vec{F}_g|\sqrt{3}}{4}$