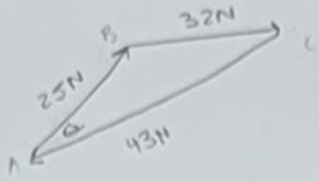
Vectors Quiz 1 Version 1 Thursday, May 9, 2024

1. Three forces of 25 N, 32 N and 43 N are in equilibrium. What is the angle between the 25 N force and the 43 N force? Round your answer to one tenth of a degree (i.e., one decimal place). /3



3

$(32)^2 = (43)^2 + (25)^2 - 2(43)(25)\cos\theta$

$\cos\theta = 0.674418$

$\theta = \cos^{-1}(0.674418)$

$\theta = 47.5909°$

$180 - 47.5909°$

$= 132.4°$

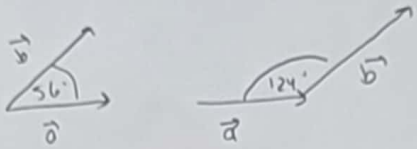
The angle is 132.4°

Round your answer to one tenth of a degree (i.e., one decimal place)

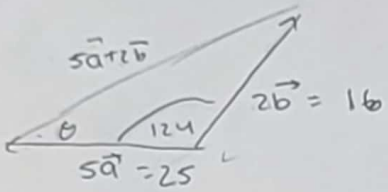
2. The vector $\vec{a}$ has a magnitude of 5 cm and the vector $\vec{b}$ has a magnitude of 8 cm. The angle between $\vec{a}$ and $\vec{b}$ is 56°.
   a. Determine the magnitude of $5\vec{a} + 2\vec{b}$, and round your answer to the nearest tenth of a cm (i.e. one decimal place) /3
   b. Determine the direction of $5\vec{a} + 2\vec{b}$ with respect to the original vectors $\vec{a}$ and $\vec{b}$ (as we have done in class). Round your angle to the nearest tenth of a degree (i.e., one decimal place). /2

$\vec{a} = 5cm$

$\vec{b} = 8cm$



5



$|5\vec{a}+2\vec{b}|^2 = (25)^2 + (16)^2 - 2(25)(16)\cos 124°$

$|5\vec{a}+2\vec{b}| = \sqrt{1328.354}$

$|5\vec{a}+2\vec{b}| = 36.4\ cm$

b) $(16)^2 = (25)^2 + (36.446)^2 - 2(25)(36.446)\cos\theta$

$\cos\theta = 0.93141$

$\theta = \cos^{-1}(0.93141)$

$\theta = 21.344°$

$|5\vec{a} + 2\vec{b}| =$ 36.4cm

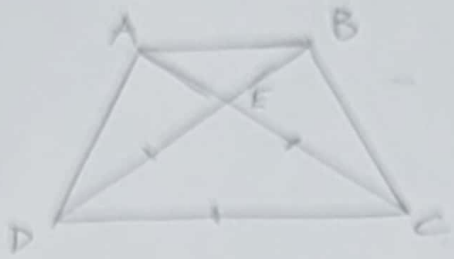
(round your answer to the nearest tenth of a cm, i.e., one decimal place)

The direction of $5\vec{a} + 2\vec{b}$ is 21.3°

∴ In a direction approx. 21.3° rotated from $\vec{a}$ towards $\vec{b}$

(in your statement, round your angle to one tenth of a degree, i.e., one decimal place)

3. Given the figure below, we know that $\overrightarrow{AB} = \frac{1}{2}\overrightarrow{DC}$. Solve for the scalar values m and n given that $\overrightarrow{AE} = m\overrightarrow{AB} + n\overrightarrow{AD}$. Show your work



$AB = \frac{1}{2}DC$

$DC = 2AB$

6

$\overrightarrow{AE} = m\overrightarrow{AB} + n\overrightarrow{AD}$

$\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$

$\overrightarrow{AC} = \overrightarrow{AD} + \overrightarrow{DC}$

$\overrightarrow{AC} = m\overrightarrow{AD} + n\overrightarrow{DC}$ (x1|3)

$\frac{1}{3}\overrightarrow{AC} = \frac{1}{3}\overrightarrow{AD} + \frac{1}{3}\overrightarrow{DC}$

$\overrightarrow{AE} = \frac{1}{3}\overrightarrow{AD} + \frac{1}{3}\overrightarrow{DC}$

$\overrightarrow{AE} = \frac{1}{3}\overrightarrow{AD} + \frac{1}{3}(2\overrightarrow{AB})$

$\overrightarrow{AE} = \frac{1}{3}\overrightarrow{AD} + \frac{2}{3}\overrightarrow{AB}$

$\overrightarrow{AE} = m\overrightarrow{AB} + n\overrightarrow{AD}$

$\overrightarrow{AE} = \frac{2}{3}\overrightarrow{AB} + \frac{1}{3}\overrightarrow{AD}$

$m = \frac{2}{3}$

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

$m = 2/3 \quad n = 1/3$