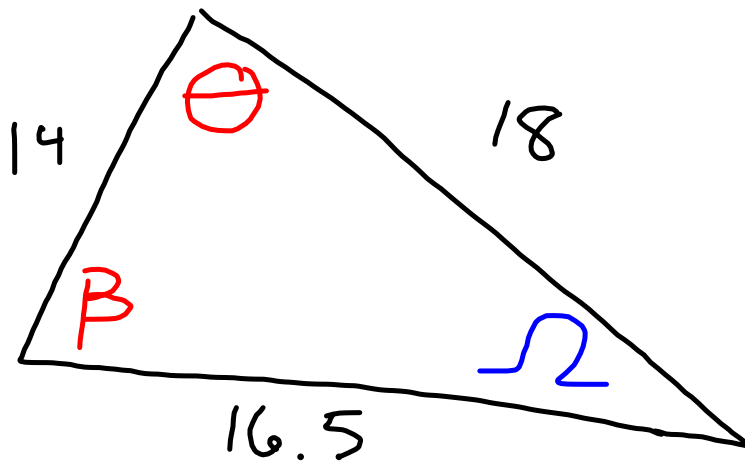


Feb. 24, 2017

Warmup: Solve the triangle



$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$16.5^2 = 14^2 + 18^2 - 2(14)(18)\cos\theta$$

$$16.5^2 - 14^2 - 18^2 = -2(14)(18)\cos\theta$$

$$272.25 - 196 - 324 = -504\cos\theta$$

$$-247.75 = -504\cos\theta$$

$$\frac{-247.75}{-504} = \cos\theta$$

$$\cos^{-1}\left(\frac{-247.75}{-504}\right) = \theta$$

$$\boxed{\theta = 60.6^\circ}$$

$$\frac{\sin \beta}{18} = \frac{\sin 60.6^\circ}{16.5}$$

$$\sin \beta = \frac{18 \cdot \sin 60.6^\circ}{16.5}$$

$$\beta = \sin^{-1} \left(\frac{18 \cdot \sin 60.6^\circ}{16.5} \right)$$

$$\boxed{\beta = 71.9^\circ}$$

$$\Omega = 180^\circ - 60.6^\circ - 71.9^\circ$$

$$\boxed{\Omega = 47.5^\circ}$$

Introduction to Vectors

A **scalar** is a quantity that describes only magnitude.

Ex. 58 kg, 200 km, 180 mph.

A **vector** is a quantity that has magnitude and direction.

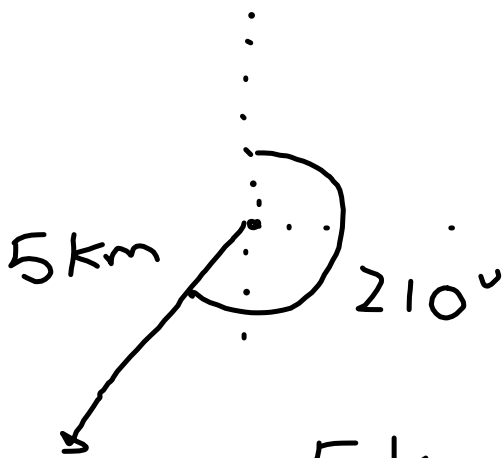
Ex. 300 km [N 30° E]

180 mph [S]

20 N [down]

A **true bearing** begins at North and rotates clockwise.

Ex. 5 km [210°]

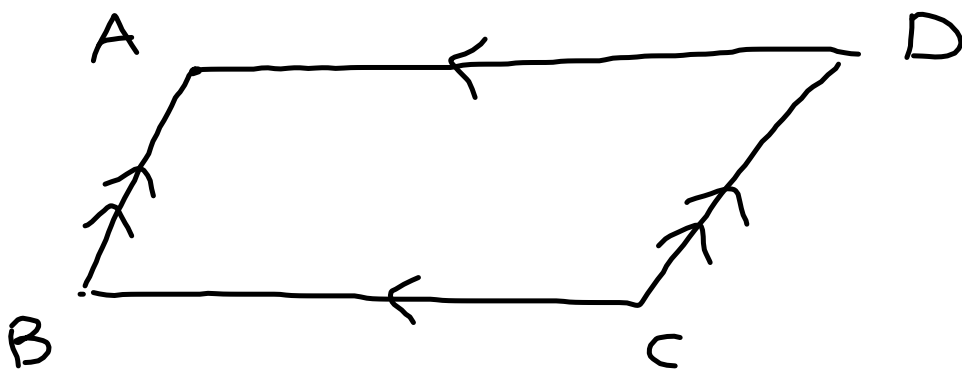


or 5 km [S 30° W]

A dot is the tail (beginning) of the vector. An arrow is the tip (end).

Two vectors are **equivalent** if they have the same magnitude and direction.

Two vectors are **opposite** if they have equal magnitude and opposite direction.



Equivalent vectors

$$\overrightarrow{AD} = \overrightarrow{BC}$$

$$\overrightarrow{AB} = \overrightarrow{DC}$$

$$\overrightarrow{DA} = \overrightarrow{CB}$$

$$\overrightarrow{BA} = \overrightarrow{CD}$$

Opposite Vectors

$$\overrightarrow{AD} = -\overrightarrow{CB}$$

$$\overrightarrow{DC} = -\overrightarrow{BA}$$

$$\overrightarrow{CD} = -\overrightarrow{DC}$$

(plus many more)

Ex. 1: Is each a vector or a scalar? If it is a vector please state its opposite

a) A ball is rolling on the floor at 2.5m/s
scalar

b) Austin is pushing a crate with a force 250N [west]
vector 250N [east]

c) A sound has intensity 50dB
scalar

d) A train travels NW at 115km/h
vector 115km [SE]

e) A box travels 700m at a bearing of 120°

vector 700m bearing 300°

f) A box has weight of 84N.
[down]

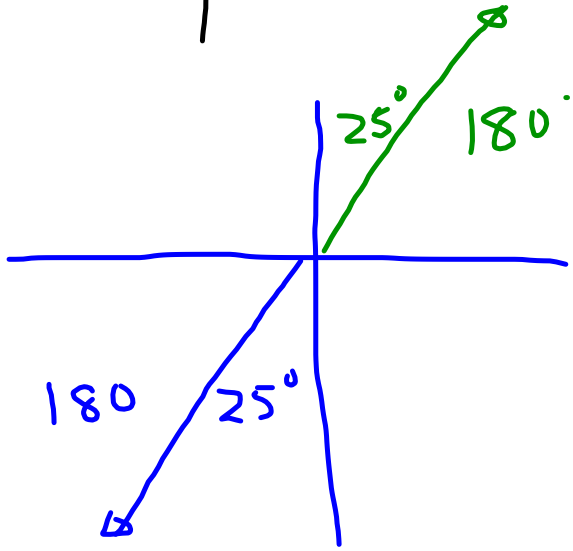
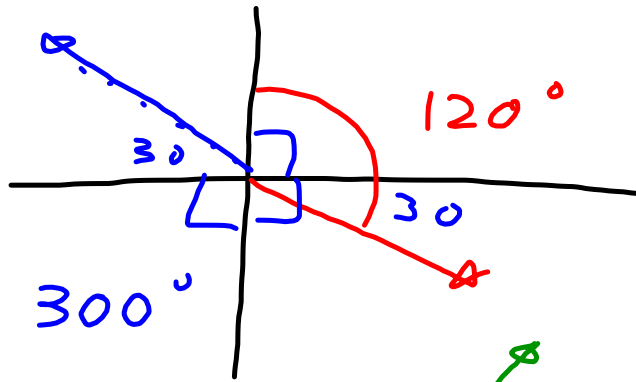
vector 84N [up]

g) The high temp. was 21°C .

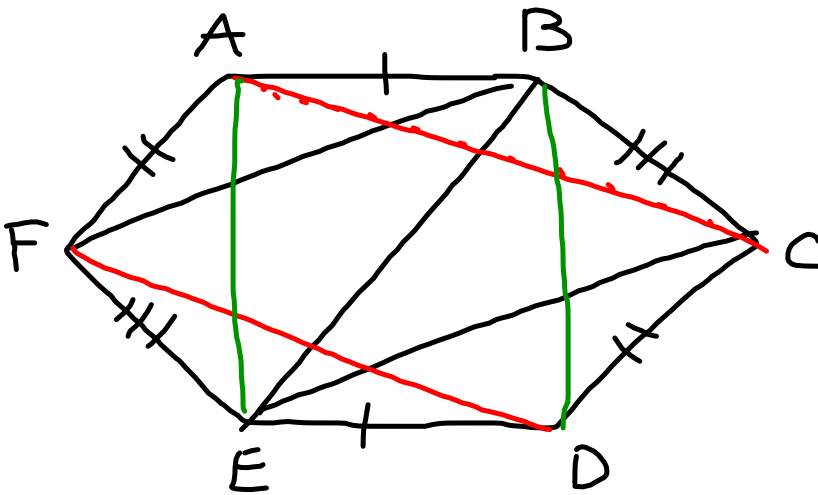
Scalar

h) Superman travels 180km [S 25° W]

vector 180km [N 25° E]



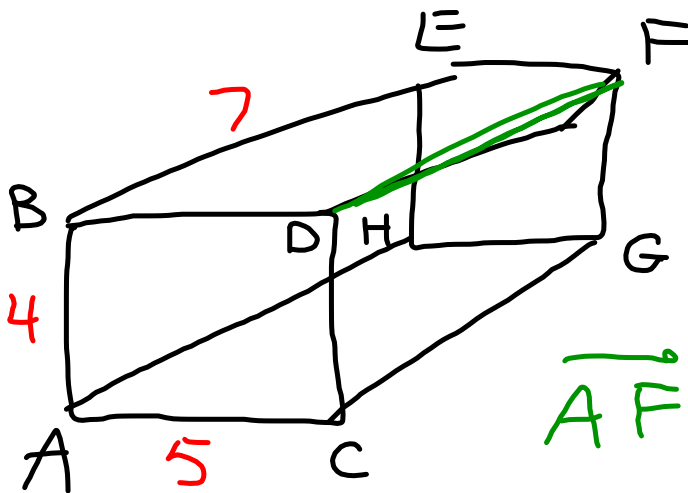
Ex. 2 : Name all the equivalent vectors



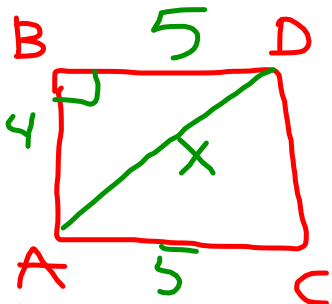
$$\begin{aligned} \vec{AB} &= \vec{ED} \\ \vec{CD} &= \vec{AF} \\ \vec{BC} &= \vec{FE} \end{aligned}$$

$$\vec{FB} = \vec{EC}$$

Ex. 3: Find the $|\vec{AF}|$
↳ magnitude



$$\vec{AF} = \vec{AD} + \vec{DF}$$



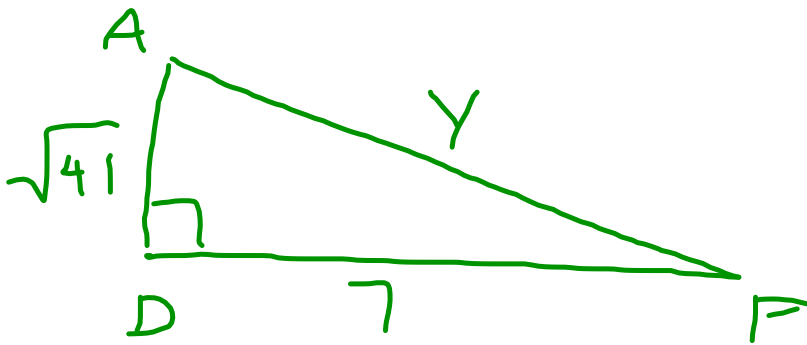
$$\overline{AC} = \overline{BD}$$

$$x^2 = 4^2 + 5^2$$

$$= 16 + 25$$

$$x = \sqrt{41}$$

Along the diagonal



$$y^2 = 7^2 + (\sqrt{41})^2$$
$$= 49 + 41$$

$$y = \sqrt{90}$$

HW p. 311

5, 6, 7, 9, 11, 17