

Find the component form of \vec{AB} . Then find the magnitude of \vec{AB} .

1. A(2, 4), B(-1, 3)

$\langle -3, -1 \rangle$ $\|\vec{AB}\| = \sqrt{10}$

2. A(4, -2), B(5, -5)

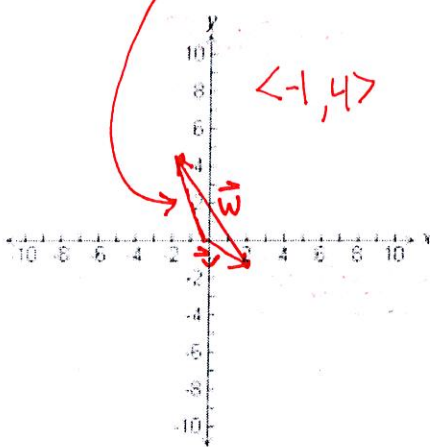
$\langle 1, -3 \rangle$ $\|\vec{AB}\| = \sqrt{10}$

3. A(-4, 2, 7), B(3, -1, 4)

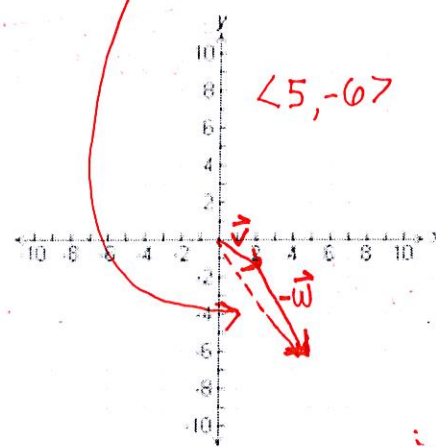
$\langle 7, -3, -3 \rangle$ $\|\vec{AB}\| = \sqrt{67}$

Let $\vec{v} = \langle 2, -1 \rangle$ and $\vec{w} = \langle -3, 5 \rangle$. Find \vec{u} and sketch the vector operations geometrically.

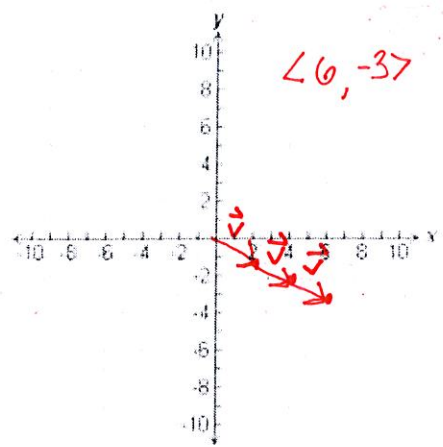
4. $\vec{u} = \vec{v} + \vec{w}$



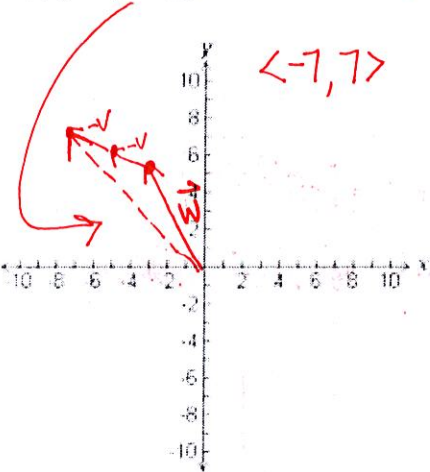
5. $\vec{u} = \vec{v} - \vec{w}$



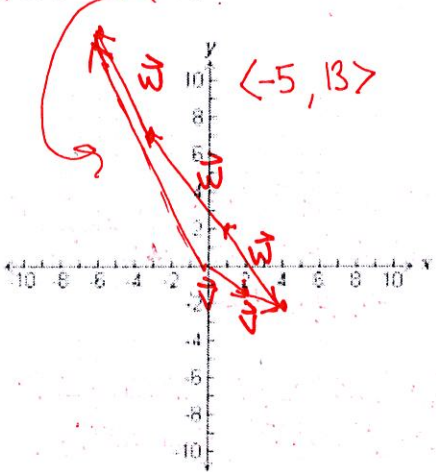
6. $\vec{u} = 3\vec{v}$



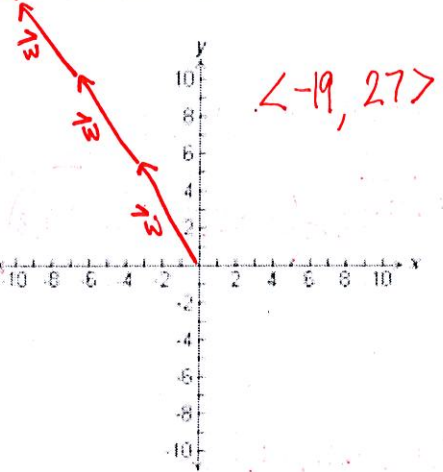
7. $\vec{u} = \vec{w} - 2\vec{v}$



8. $\vec{u} = 2\vec{v} + 3\vec{w}$



9. $\vec{u} = 5\vec{w} - 2\vec{v}$



Find a unit vector for each vector.

10. $\vec{u} = \langle -3, 4 \rangle$

$\langle \frac{-3}{5}, \frac{4}{5} \rangle$

11. $\vec{v} = \vec{i} + 5\vec{j}$

$\langle \frac{\sqrt{26}}{26}, \frac{5\sqrt{26}}{26} \rangle$

Find the direction angle of each vector. Pay attention to the appropriate quadrant using values $[0, 360]$.

12. $\vec{u} = 2\vec{i} - 5\vec{j}$

$\tan^{-1}(\frac{-5}{2}) = -68.2 + 360 = 291.8^\circ$

13. $\vec{u} = -3\vec{i} - 7\vec{j}$

$\tan^{-1}(\frac{-7}{-3}) = 66.8 + 180 = 246.8^\circ$

14. $\vec{u} = 6\vec{i} - 2\vec{j}$

$\tan^{-1}(\frac{-2}{6}) = -18.43 + 360 = 341.57^\circ$

Find the component form of each vector.

15. $\|u\| = 20, \theta = 150^\circ$

$\langle 20\cos 150^\circ, 20\sin 150^\circ \rangle$
 $\langle -10\sqrt{3}, 10 \rangle$

16. $\|u\| = 10, \theta = 315^\circ$

$\langle 10\cos 315^\circ, 10\sin 315^\circ \rangle$
 $\langle 5\sqrt{2}, -5\sqrt{2} \rangle$

Find $\vec{v} \cdot \vec{w}$.

17. $\vec{v} = 5\vec{i} - 2\vec{j}$, $\vec{w} = -3\vec{i} + \vec{j}$

-17

18. $\vec{v} = 3\vec{i} - 9\vec{j} + 2\vec{k}$, $\vec{w} = 2\vec{i} + \vec{j} - 4\vec{k}$

$6 - 9 - 8 = -11$

Find the angle θ between \vec{v} and \vec{w} .

19. $\vec{v} = 5\vec{i} - 2\vec{j}$, $\vec{w} = -3\vec{i} + \vec{j}$

$\cos\theta = \frac{-17}{\sqrt{29} \cdot \sqrt{10}} \Rightarrow \theta = 176.63^\circ$

20. $\vec{v} = 3\vec{i} - 9\vec{j} + 2\vec{k}$, $\vec{w} = 2\vec{i} + \vec{j} - 4\vec{k}$

$\cos\theta = \frac{-11}{\sqrt{94} \cdot \sqrt{21}} \Rightarrow \theta = 104.33^\circ$

Translate the following points to polar coordinates. Give all answers in $0 < \theta < 360^\circ$.

25. $(-5, 7)$

~~$(\sqrt{74}, 54.46^\circ)$~~

$(\sqrt{74}, 125.54^\circ)$

26. $(3, -7)$

$(\sqrt{58}, 293.20^\circ)$

$(-\sqrt{58}, 113.20^\circ)$

27. $(-5, -12)$

$(13, 247.38^\circ)$

$(-13, 67.38^\circ)$

Plot the following points, then translate them to rectangular coordinates.

28. $(25, 225^\circ)$

$(\frac{-25\sqrt{2}}{2}, \frac{-25\sqrt{2}}{2})$

29. $(8, 11\pi/6)$

$(4\sqrt{3}, -4)$

30. $(6, 133^\circ)$

$(-4.09, 4.39)$

For the following complex numbers, a) plot the number, b) find the absolute value

31. $5 - 4i$

$\sqrt{41}$

32. $4 + 2i$

$2\sqrt{5}$

33. $-6 + 3i$

$3\sqrt{5}$

Application problems

A boat is traveling at 23 knots at a trajectory of 12° South of East. It is going against a current that is flowing 5 knots SW.

a. Find the resultant vector of the boat.

$V_b = \langle 23\cos(-12^\circ), 23\sin(-12^\circ) \rangle$
 $V_c = \langle 5\cos 225^\circ, 5\sin 225^\circ \rangle$

$V_b + V_c = \langle 18.96, -8.32 \rangle$

b. What is the speed of the boat including the current?

$\sqrt{18.96^2 + (-8.32)^2} = 20.71$ knots

c. What is the trajectory of the boat including the current?

$\tan^{-1}(\frac{-8.32}{18.96}) = -23.69^\circ$ 23.69° South of due East.

d. If the boat is trying for land that is exactly 100 knots east of its current position, how long will it take to get there? How far south of its current position will it land?

$\frac{100 \text{ distance}}{18.96 \text{ horizontal speed}} = 5.27$ time

$5.27 \cdot 8.32 = 43.88$ south.



A plane is traveling at 540 mph with a bearing of 200° . It is traveling against a headwind blowing at 26 mph NE.

Unit circle = 250°

a. Find the resultant vector of the plane.

$V_p = \langle 540\cos 250^\circ, 540\sin 250^\circ \rangle$ $V_w = \langle 26\cos 45^\circ, 26\sin 45^\circ \rangle$

$V_p + V_w = \langle -166.31, -489.05 \rangle$

b. What is the groundspeed of the plane including the wind?

166.31 mph

c. What is the bearing of the plane including the wind?

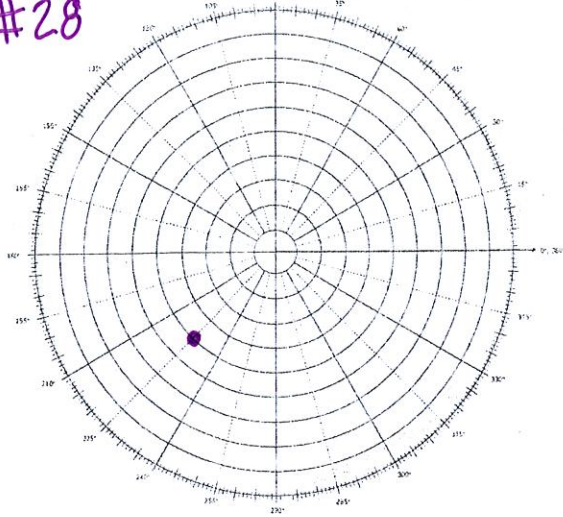
$\tan^{-1}(\frac{-489.05}{-166.31}) = 71.21^\circ + 180^\circ = 251.22^\circ$ unit circle!

Bearing: 198.78°

*See graphs next page.

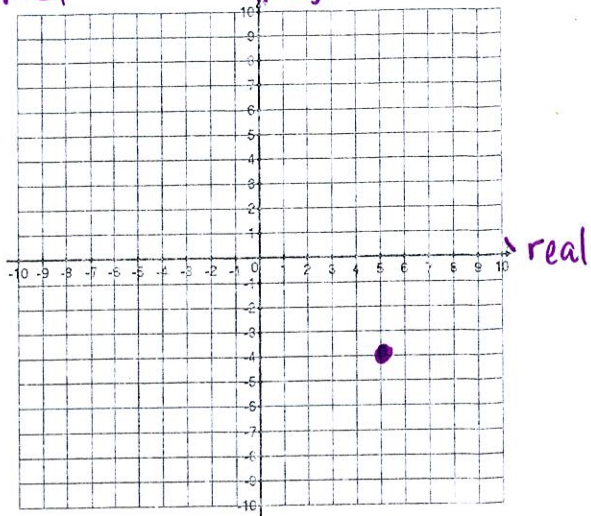
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each circle = r of 5.

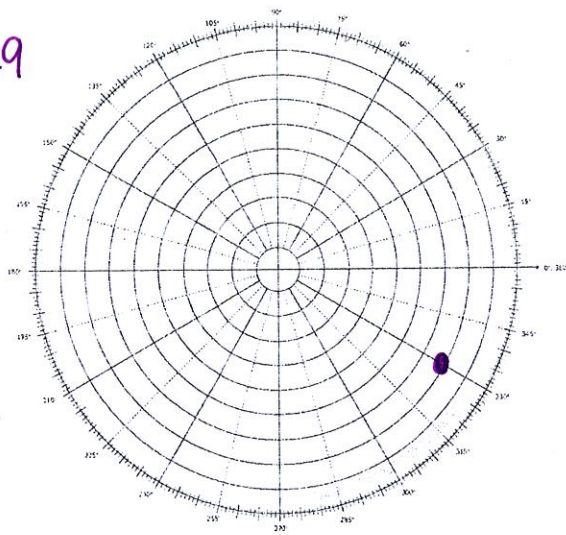


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imaginary

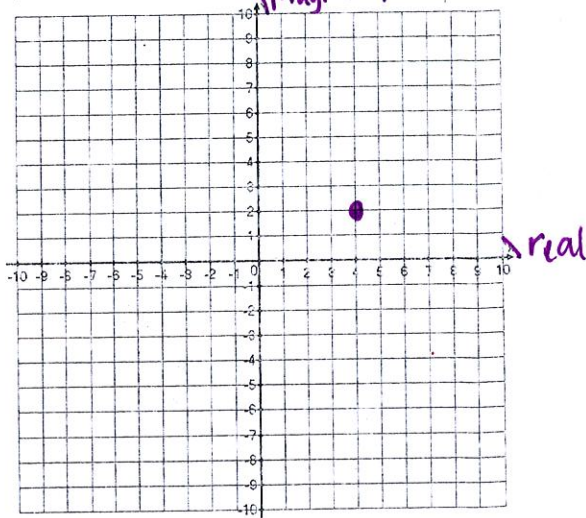


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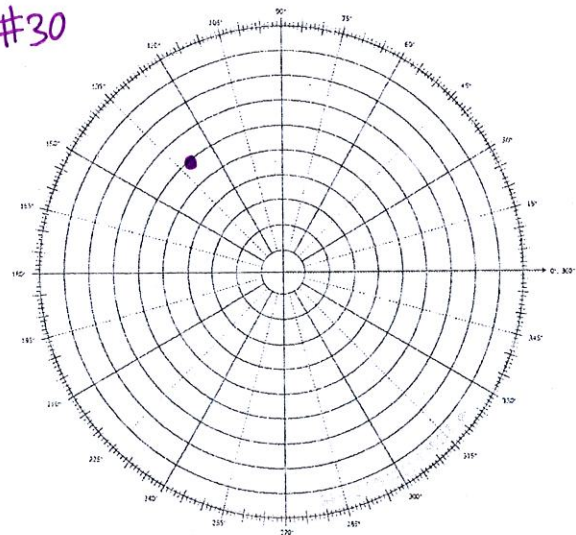


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imaginary



#30



#33

imaginary

