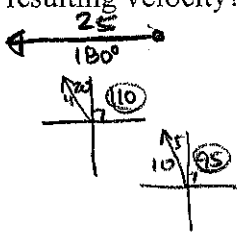
GSE PreCalculus
Test 7 Review – Vectors

Name _____
Date _____ Day _____

1. Mr. Jones is traveling in his powerboat at 25mph directly west. The current is flowing at 4 mph in the direction of $N20^\circ W$. There is also a tailwind of 10mph blowing in the direction of $N5^\circ W$. Find the resulting velocity?



$\langle 25\cos 180, 25\sin 180\rangle$
$\langle 4\cos 110, 4\sin 110\rangle$
$\langle 10\cos 95, 10\sin 95\rangle$

$\langle -27.2, 13.7\rangle$

speed = 30.5 mph
direction = 153.3°
$-26.7+180$

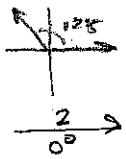
2. An airplane is traveling 335 miles per hour and heading $N40^\circ E$. The wind is blowing at 20 miles per hour in the direction of $S20^\circ E$. What is the resulting velocity of the plane?

$\langle 335\cos 50^\circ, 335\sin 50^\circ\rangle$
$\langle 20\cos 290^\circ, 20\sin 290^\circ\rangle$

$\langle 227.2, 237.8\rangle$

speed = 325.5
direction = 46.9°

3. A ship near the coast is going 7 knots at an angle of 125°. The current is flowing directly due east at 2 knots. What is the ship's resultant velocity?

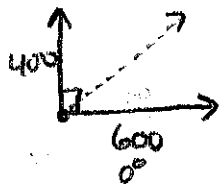


$\langle 7\cos 125, 7\sin 125\rangle$
$\langle 2\cos 0, 2\sin 0\rangle$

$\langle -2.1, 5.7\rangle$

speed = 6.1
direction = 110.2°
$-69.8+180$

4. In a 3-person tug-of-war, three ropes are tied at a point. Adam is pulling east with a force of 600 newtons, Barry is pulling north with a force of 400 newtons, and Cal is pulling the third rope. The knot in the middle is not moving. Find the direction and magnitude of Cal's effort.

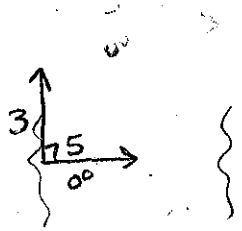


$\langle 600\cos 0^\circ, 600\sin 0^\circ\rangle$
$\langle 400\cos 90^\circ, 400\sin 90^\circ\rangle$

$\langle 600, 400\rangle$

magnitude = 721.1 N
direction = 33.7°

5. A motorboat is traveling across a river from one shore to the other in the direction of due east at 5 m/s. The boat encounters a current going due north at 3 m/s. What is the resultant velocity (speed and direction)? If the river is 60 meters wide, how long does it take to get from one shore to the other?



$\langle 5\cos 0^\circ, 5\sin 0^\circ\rangle$
$\langle 3\cos 90^\circ, 3\sin 90^\circ\rangle$

$\langle 5, 3\rangle$

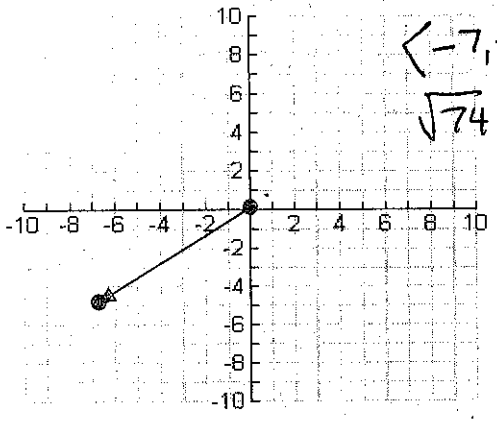
speed = 5.8 m/s
direction = 30.96 ≈ 31°

$\frac{60\text{ m}}{5.8\text{ m/s}} = 10.3$ 10.3 seconds

1. Show that vector u and vector v are equal
Vector u: initial: (2, -5), terminal: (-1, 4)
Vector v: initial: (7, 1), terminal: (4, 10)

$4+1=5$, $-1-2$ $\langle -3,9\rangle$ $4-7$, $10-1$ $\langle -3,9\rangle$

2. Find the component form and the magnitude of the vetor v.



$\langle -7,-5\rangle$

$\sqrt{74} = 8.6$

Find a.) $u-v$ b.) $-3u+2v$ c.) $-v+5u$

3. $u=\langle 2,3\rangle$ $v=\langle -3,0\rangle$

a. $\langle 5,3\rangle$

b. $\langle -12,-9\rangle$

c. $\langle 13,15\rangle$

4. $u=\langle 2,-1\rangle$ $v=\langle -4,7\rangle$

a. $\langle 6,-8\rangle$

b. $\langle -14,17\rangle$

c. $\langle 14,-12\rangle$

Find the magnitude and direction of each vector.

5. $u=\langle 3,-5\rangle$

mag = 5.8

direct = $-59.04°$

6. $v=\langle -2,3\rangle$

mag = 3.6

direct = ~~$-56.3°$~~ $123.7°$

Find the component form given magnitude and direction

7. $\|v\|=2$ $\theta=-53°$ $\langle 1.2,-1.6\rangle$

8. $\|v\|=3$ $\theta=60°$ $\langle 1.5, 2.6\rangle$

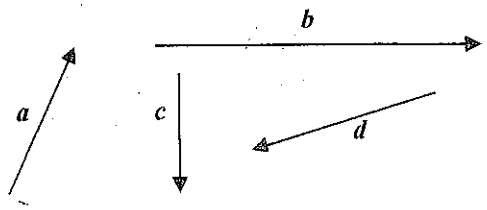
9. $\|v\|=4$ $\theta=110°$ $\langle -1.4, 3.8\rangle$

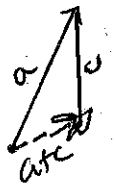
Draw the resulting vector using tip-to-tail or parallelogram method.

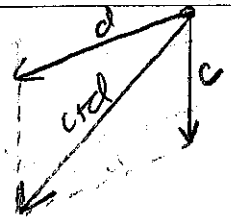
10. $a+c$

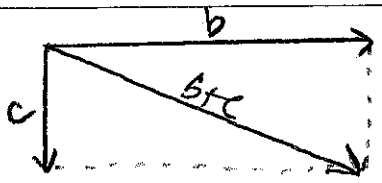
11. $c+d$

12. $b+c$









Cumulative Review Questions from Tests 1-6:

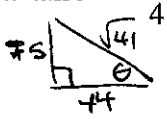
1. Identify the following conics: a. $\frac{(x-3)^2}{10}-\frac{y^2}{4}=1$ hyperbola b. $(x+1)^2+y^2=16$ ~~ellipse~~ Circle

2. Multiply the following matrices: $\begin{bmatrix}2 & 9\\ -7 & 3\end{bmatrix}\cdot\begin{bmatrix}6 & -4\\ 0 & 3\end{bmatrix}$ $\begin{bmatrix}12 & 19\\ -42 & 37\end{bmatrix}$

3. Solve the linear system: $\begin{aligned}7x+4y&=-17\\ 8x+5y&=-19\end{aligned}$ $\begin{bmatrix}-3\\ 1\end{bmatrix}$

4. Find a positive co-terminal angle to: a. $\theta=-\frac{2\pi}{5}$ $\frac{8\pi}{5}$ b. $\theta=\frac{\pi}{7}$ $\frac{15\pi}{7}$

5. If $\tan\theta=-\frac{5}{4}$ and θ is in quadrant 4, what is the exact value of cos θ? $\cos\theta = +\frac{4}{\sqrt{41}} = +\frac{4\sqrt{41}}{41}$



6. Find the reference angle: a. $\theta=210°$ $30°$ b. $\theta=315°$ $45°$

7. Find the exact value of the following function: $\sin\left(-\frac{4\pi}{3}\right)$ $\frac{\sqrt{3}}{2}$

8. Evaluate $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ in degrees and radians $30°$

9. Find the amplitude, period, horizontal shift, and vertical shift for $f(x)=3\sin\left(x+\frac{\pi}{4}\right)+7$.
Amp = 3 HS = $-\pi/4$ period = 2π VS = 7

10. Evaluate $\arcsin\left(-\frac{1}{2}\right)$ $-30° = 330°$

11. Simplify: $\frac{\sec^2\theta-1}{\sin^2\theta}$ $\frac{\tan^2x}{\sin^2x} = \frac{\frac{\sin^2x}{\cos^2x}}{\frac{\sin^2x}{1}} = \frac{\sin^2x}{\cos^2x}\cdot\frac{1}{\sin^2x} = \frac{1}{\cos^2x} = \sec^2x$

12. Solve for x: $2\sin x-\sqrt{3}=0$ $60°$

13. Evaluate: $\sin 105°$ (use $105°=45°+60°$) $\sin(\alpha\pm\beta)=\sin\alpha\cos\beta\pm\cos\alpha\sin\beta$ $\frac{\sqrt{2}+\sqrt{6}}{4}$
$\sin45\cos60 + \cos45\sin60$ $\left(\frac{\sqrt{2}}{2}\right)\left(\frac{1}{2}\right)+\left(\frac{\sqrt{2}}{2}\right)\left(\frac{\sqrt{3}}{2}\right)$

14. Given a triangle with $A=20°, B=50°$, and $a=5$, find c.
$\frac{\sin20}{5}=\frac{\sin110}{c}$ 13.7

15. What is the area of a triangle with sides of 5, 7, and 9. Use $Area=\sqrt{s(s-a)(s-b)(s-c)}$
17.4