

Fall 2021 Math 151

Week in Review I

courtesy: Amy Austin

(covering appendix J_1, J_2)

1. Draw the vector with initial point $A(4, -1)$ and terminal point $B(6, 3)$. Find the components of \vec{AB} .

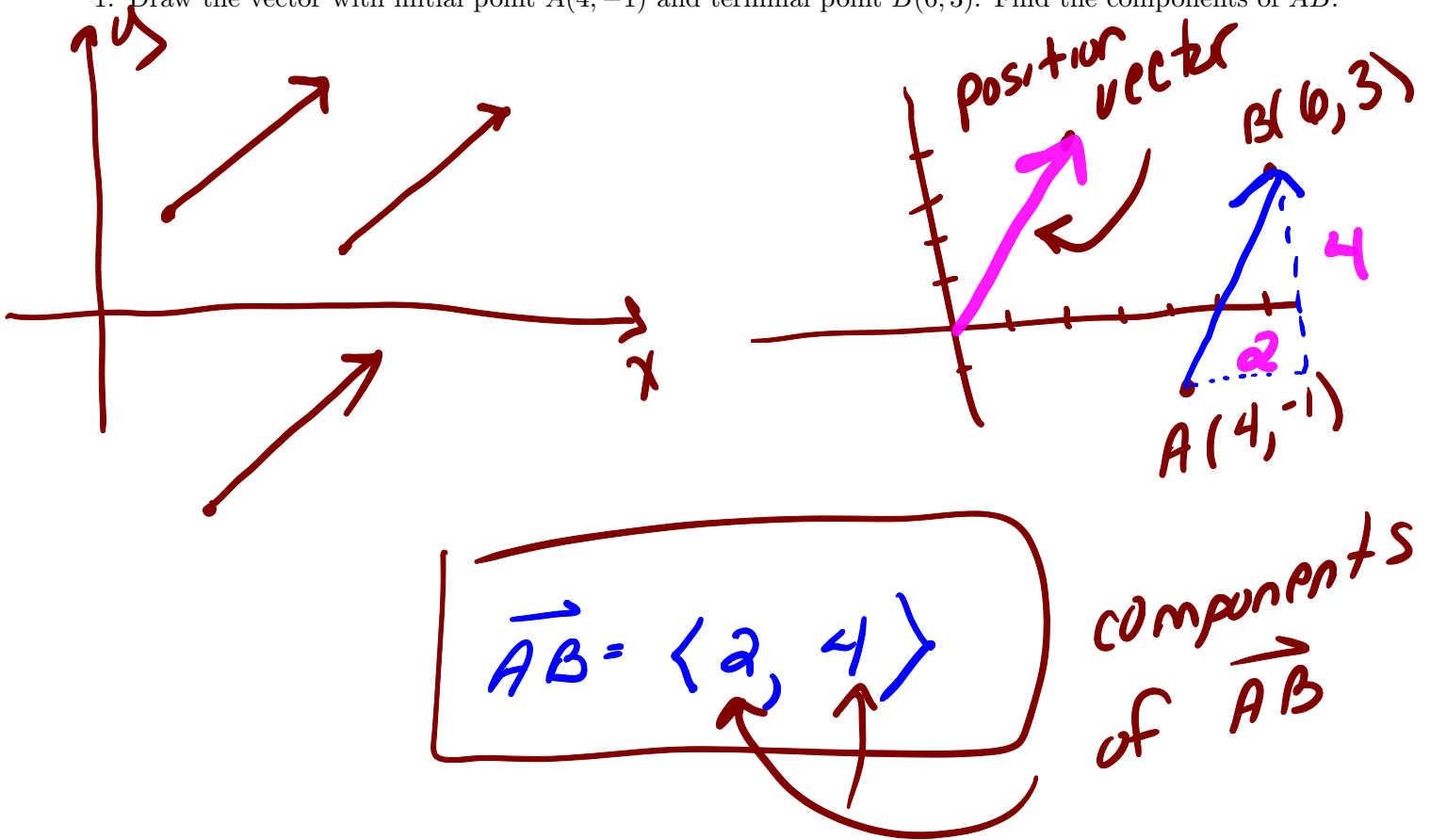
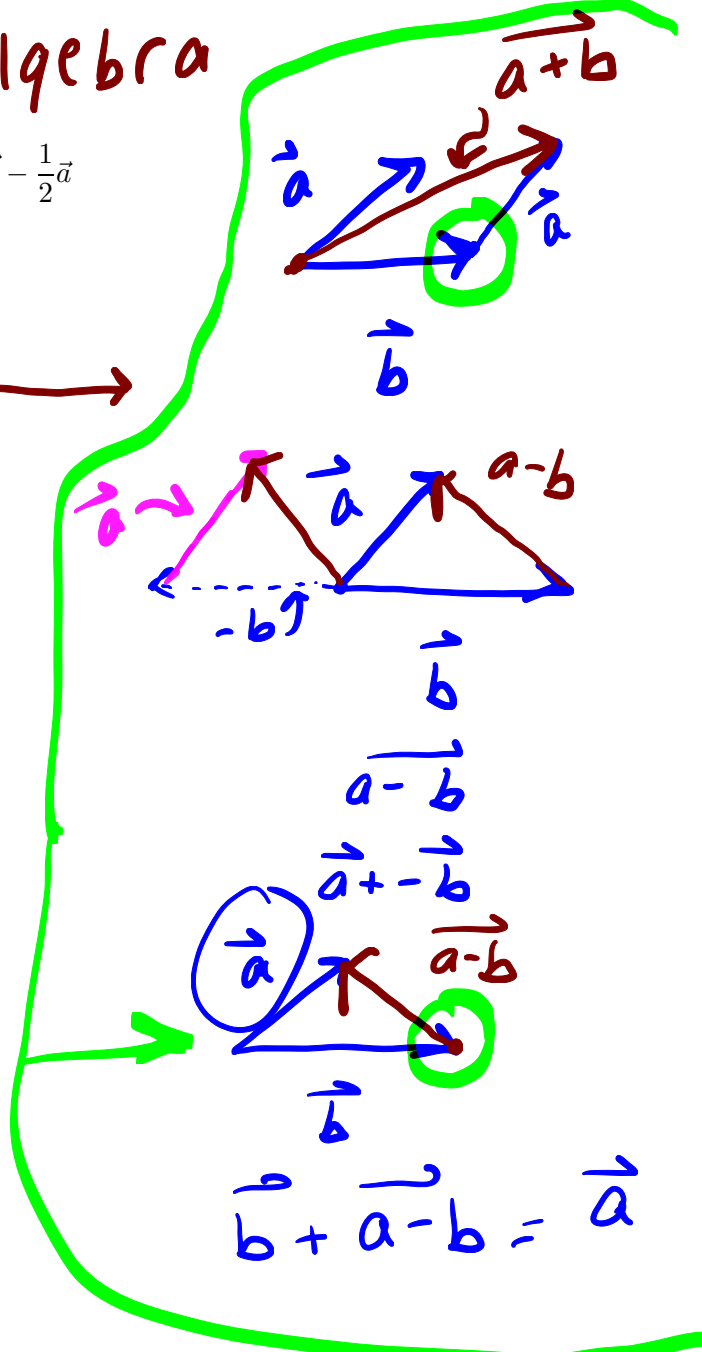
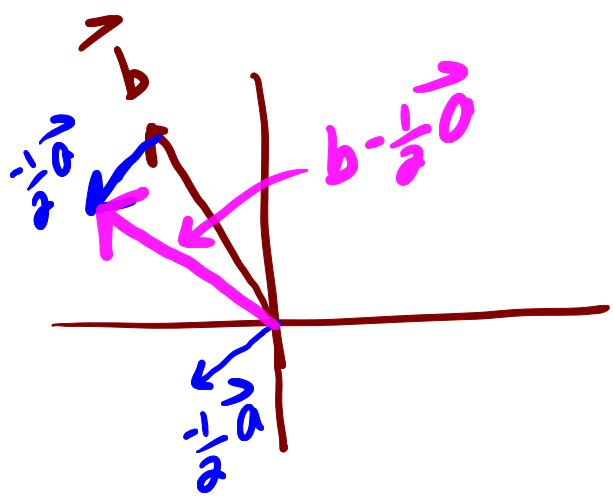
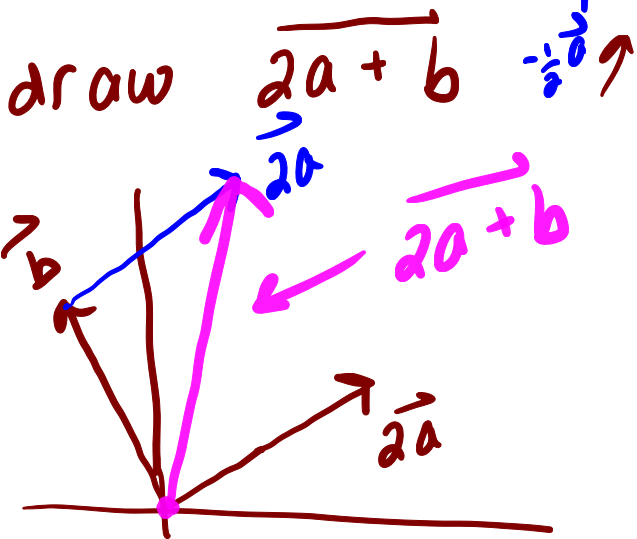
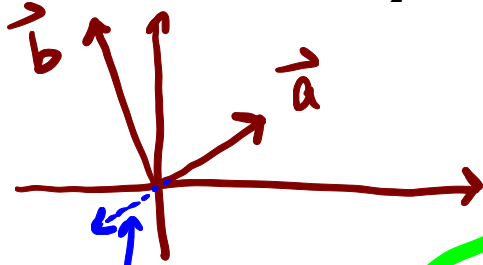
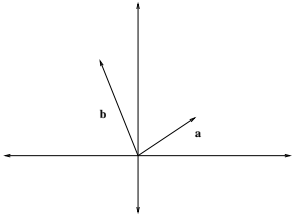


illustration of vector algebra

2. Refer to the figure below to draw the vector $2\vec{a} + \vec{b}$ and $\vec{b} - \frac{1}{2}\vec{a}$



$$\vec{b} - \frac{1}{2}\vec{a} = \vec{b} + \frac{-1}{2}\vec{a}$$

3. Given $\mathbf{a} = \mathbf{i} + 2\mathbf{j}$ and $\mathbf{b} = -2\mathbf{i} + 3\mathbf{j}$:

a.) Find $|\mathbf{a}|$.

$$|\langle a_1, a_2 \rangle| = \sqrt{a_1^2 + a_2^2}$$



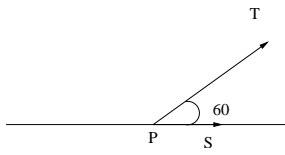
b.) Find a unit vector in the direction of \mathbf{b} .

c.) Find $3\mathbf{a} - 2\mathbf{b}$.

d.) Find scalars s and t so that $s\mathbf{a} + t\mathbf{b} = \mathbf{c}$, where $\mathbf{c} = \langle 4, 6 \rangle$.

4. Sandy walks due east on the deck of a ship at 2 mph. The ship is moving south at 20 mph. Find the speed and direction of Sandy relative to the surface of the water.

5. Two forces T and S with magnitudes 4 pounds and 2 pounds act on an object at a point P as shown. Find the resultant force as well as its magnitude and direction.



6. Suppose a wind is blowing from the direction $N45^\circ W$ at a speed of 55 km/hr. A pilot is steering a plane in the direction $N60^\circ E$ at an airspeed (speed in still air) of 226 km/hr. Find the true course (the direction of the resultant of the velocity vectors of the plane and the wind) and the ground speed (the magnitude of the resultant) of the plane.

7. Find $\mathbf{a} \cdot \mathbf{b}$ given the following information:

a.) $\mathbf{a} = \langle 1, 5 \rangle$ and $\mathbf{b} = \langle -2, 3 \rangle$.

b.) $|\mathbf{a}| = 5$, $|\mathbf{b}| = 3$, and the angle between \mathbf{a} and \mathbf{b} is 60° .

8. Find the angle between the vectors $\langle 2, 4 \rangle$ and $\langle -1, 3 \rangle$.

9. Given the points $A(1, 0)$, $B(2, 3)$ and $C(-1, 7)$, find the angle located at the point C .

10. For what value of c is the angle between the vectors $\mathbf{a} = \langle 1, 1 \rangle$ and $\mathbf{b} = \langle 1, c \rangle$ equal to 60° ?

11. Find a unit vector that is orthogonal to $\mathbf{a} = 5\mathbf{i} + \mathbf{j}$.

12. Find the scalar and vector projection of $\langle 1, 5 \rangle$ onto $\langle 6, 2 \rangle$.

13. Find the work done by a force of 25 pounds acting in the direction of $N30^\circ W$ in moving an object 8 feet due west.

14. A force given by $\mathbf{F} = 3\mathbf{i} + 4\mathbf{j}$ moves an object from the point $P(2, 1)$ to the point $Q(4, 6)$. Find the work done.