Honors Pre-Calculus  Projection, positive unit normal

\[ \vec{a} = 3\hat{i} + 5\hat{j} \quad \vec{b} = 4\hat{i} - \hat{j} \quad \vec{w} = 2\hat{i} + 8\hat{j} \quad A(2, -3) \quad B(-3, -4) \quad C(4, 0) \quad D(0, -3) \]

Find the following:

1. Vector with same direction as \( \vec{b} \), but 1 unit long.
   \[ \vec{n} = \left( \frac{4}{\sqrt{17}}, -\frac{1}{\sqrt{17}} \right) \]

2. Projection of \( \vec{u} \) onto \( \vec{b} \). And illustrate \( \vec{u} \), \( \vec{b} \) and projection below left.

3. Vector with same direction as \( \vec{a} \), but 1 unit long.
   \[ \vec{n} = \left( \frac{3}{\sqrt{34}}, \frac{5}{\sqrt{34}} \right) \]

4. Projection of \( \vec{v} \) onto \( \vec{a} \). And illustrate \( \vec{a} \), \( \vec{v} \) and projection above right.

5. Vector with same direction as \( \vec{AC} \), but 1 unit long.
   \[ \vec{AC} = \left< 2, 3 \right> \quad \vec{n} = \left< \frac{2}{\sqrt{13}}, \frac{3}{\sqrt{13}} \right> \]

6. Projection of \( \vec{AB} \) onto \( \vec{AC} \). And illustrate \( \vec{AB} \), \( \vec{AC} \) and projection below left.

7. Vector with same direction as \( \vec{w} \), but 1 unit long.
   \[ \vec{n} = \left< \frac{2}{\sqrt{66}}, \frac{5}{\sqrt{66}} \right> \]

8. Projection of \( \vec{v} \) onto \( \vec{w} \). And illustrate \( \vec{v} \), \( \vec{w} \) and projection above right.

9. Positive Unit Normal of \( 3x - 2y - 6 = 0 \).
   \[ \vec{n} = \left< \frac{3}{\sqrt{13}}, -\frac{2}{\sqrt{13}} \right> \]

10. Positive Unit Normal of \( x + 9y = 18 \).
    \[ \vec{n} = \left< \frac{1}{\sqrt{82}}, -\frac{9}{\sqrt{82}} \right> \]

11. Positive Unit Normal of \( y - 5 = 3(x - 2) \).
    \[ \vec{n} = \left< \frac{2}{3}, \frac{10}{3} \right> \]

12. Positive Unit Normal of \( y = \frac{2}{3}x + 4 \).
    \[ \vec{n} = \left< -\frac{2}{3}, \frac{1}{3} \right> \]