

Precalculus
Assignment 11 - Cumulative Review

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Per 1 Date 11/8/17

1. Write the component form of the vector \overline{PQ} where $P = (-5, -8)$ and $Q = (12, 9)$?

$$\langle 17, 17 \rangle$$

2. Write \overline{PQ} as a linear combination.

$$17i + 17j$$

3. Find $\|\overline{PQ}\|$.

$$17^2 + 17^2 = 578$$

$$\sqrt{578} \approx 24.04$$

4. Find the direction angle for \overline{PQ} .

$$\tan^{-1}\left(\frac{17}{17}\right) = 45^\circ \quad N45^\circ E$$

Use vectors $u = \langle 5, 12 \rangle, v = \langle -3, 8 \rangle, w = \langle 5, 4 \rangle, f = \langle -2, -5 \rangle, d = \langle 4, -7 \rangle$ to answer #5-12

5. $v + w$

$$\langle -3, 8 \rangle + \langle 5, 4 \rangle$$

$$= \langle 2, 12 \rangle$$

6. $(u \cdot v)w$

$$-15 + 96 = 81$$

$$81 \cdot \langle 5, 4 \rangle = \langle 405, 324 \rangle = 13$$

7. $\|u\|$

$$25 + 144 = 169$$

8. $3f - 2d$

$$\langle -6, -15 \rangle - \langle 8, -14 \rangle$$

$$= \langle -14, -1 \rangle$$

9. The unit vector in the same direction as v .

$$\langle -3, 8 \rangle \text{ mag} = 9 + 64 = \sqrt{73}$$

$$\frac{\langle -3, 8 \rangle}{\sqrt{73}}$$

10. The direction angle for f .

$$\tan^{-1}\left(\frac{-5}{-2}\right) \approx 68.2$$

11. $f \cdot d$

$$\langle -8 \rangle + \langle 35 \rangle = 27$$

12. The angle between f and d .

$$\cos \theta = \frac{f \cdot d}{\|f\| \|d\|} = \frac{27}{\sqrt{29} \cdot \sqrt{65}}$$

$$\cos^{-1}\left(\frac{27}{\sqrt{1885}}\right)$$

$$\theta \approx 51.55^\circ$$

Use Points $A = (7, 2, 15), B = (3, -7, -11), C = (-8, 2, 4), D = (-5, -5, -5)$ to answer #13-21

Determine the length of each segment.

Determine the midpoint of each segment.

13. \overline{AB}

$$d = \sqrt{(7-3)^2 + (2+7)^2 + (15+11)^2}$$

$$\approx 27.8$$

14. \overline{BD}

$$\approx 10.2$$

15. \overline{CD}

$$\left(\frac{-13}{2}, \frac{3}{2}, \frac{1}{2}\right)$$

16. \overline{AC}

$$\left(\frac{-1}{2}, 2, \frac{19}{2}\right)$$

Find the component form of each vector.

17. \overline{BA}

$$\langle 4, 9, 26 \rangle$$

18. \overline{BC}

$$\langle -11, 9, 15 \rangle$$

19. \overline{DA}

$$\langle 12, 7, 20 \rangle$$

20. Determine the angle between the vectors: \overline{BA} and \overline{BC}

$$\cos \theta = \frac{\overline{BA} \cdot \overline{BC}}{\|\overline{BA}\| \|\overline{BC}\|} = \cos \theta = \frac{427}{\sqrt{773} \cdot \sqrt{427}} \quad \theta \approx 41.99^\circ$$

21. Find a vector that is orthogonal to both \overline{BA} and \overline{BC} .

$$\overline{BA} \times \overline{BC} =$$

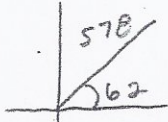
$$\begin{vmatrix} i & j & k \\ 4 & 9 & 26 \\ -11 & 9 & 15 \end{vmatrix}$$

$$(135i - 286j + 36k) - (-99k + 234i + 60j)$$

$$99i - 346j + 135k$$

APPLICATIONS

22. Find the component form of the vector for a missile launched at 62° with a velocity of 578 mph.

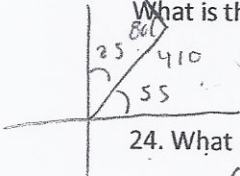


$$\langle 578 \cos 62, 578 \sin 62 \rangle$$

$$\langle 271.35, 510.34 \rangle$$

23. A jet is flying on a bearing of $N35^\circ E$ at 410 mph. A cross wind of 75 mph is blowing on a bearing of $N80^\circ W$.

What is the actual speed of the plane?



$$\langle 410 \cos 55, 410 \sin 55 \rangle + \langle 75 \cos 170, 75 \sin 17 \rangle$$

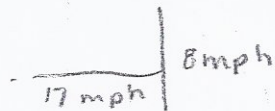
$$\langle 161.31, 348.88 \rangle$$

$$\text{mag} \approx 384.37 \text{ mph}$$

24. What is the actual bearing of the jet?

$$\tan^{-1} \left(\frac{348.88}{161.31} \right) \approx N 24.81^\circ E$$

25. A boat is pointed straight across a river that flows at a rate of 8 mph. If the engine pushes the boat at 17 mph, how fast does the boat actually travel?



$$\langle 17 \cos 0, 17 \sin 0 \rangle + \langle 8 \cos 90, 8 \sin 90 \rangle$$

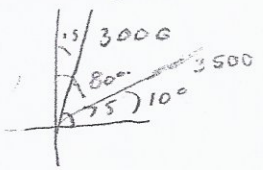
$$\langle 17, 8 \rangle \quad \text{speed} \approx 18.79 \text{ mph}$$

26. Two tugboats pull on a disabled ship. The first pulls at $N15^\circ E$ with a force of 3000 pounds. The second pulls with a force of 3500 pounds at $N80^\circ E$. What is the resulting combined force exerted on the ship?

$$\langle 3000 \cos 75, 3000 \sin 75 \rangle +$$

$$\langle 3500 \cos 10, 3500 \sin 10 \rangle$$

$$\approx \langle 4223.28, 3505.55 \rangle$$



27. What is the bearing of the path of the disabled ship?

$$\tan^{-1} \left(\frac{3505.55}{4223.28} \right)$$

$$\approx 39.69 \quad N 50.31^\circ E$$