LESSON MAKER PRO

Vector Shape Shift

Move among component, linear, and trigonometric forms.

HIGH SCHOOL · MA.912.NSO.3.2

MA.912.NSO.3.2 "Represent vectors in component form, linear form or trigonometric form. Rewrite vectors from one form to another."

NAME _____ DATE _____

THREE VECTOR FORMS

In component form, <a,b> matches linear form ai + bj. To write trigonometric form, find r = sqrt(a^2 + b^2), then use r(cos theta i + sin theta j), where theta is measured counterclockwise from the positive x-axis.

WORKED EXAMPLE

Rewrite <9,40> in linear form and trigonometric form.

1. Linear form: 9i + 40j.
2. Find the magnitude: sqrt(9^2 + 40^2) = sqrt(1681) = 41.
3. The vector is in Quadrant I, so theta = $\tan^{-1}$(40/9).
4. Trig form: 41(cos theta i + sin theta j).

Answer: 9i + 40j; 41(cos($\tan^{-1}$(40/9))i + sin($\tan^{-1}$(40/9))j)

PRACTICE 6 problems

1 Rewrite <6,-8> in linear form.

ANSWER _____

2 Rewrite -11i + 14j in component form.

ANSWER _____

3 Rewrite 12(cos 30°i + sin 30°j) in linear form.

ANSWER _____

4 Rewrite 16(cos 120°i + sin 120°j) in component form.

ANSWER _____

5 Rewrite <-7,24> in trigonometric form.

ANSWER _____

6 Rewrite 20(cos 225°i + sin 225°j) in linear form.

ANSWER _____

APPLY IT Show your work

1 During a drone club test, a drone flies 16 meters at a direction angle of 210° from east. Write its displacement in linear form, where i points east and j points north.

WORK SPACE

ANSWER _____

2 A video crew's map uses i for east and j for north. A camera cart moves -20i + 21j meters. Write the displacement in trigonometric form.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Let u = 8(cos 60°i + sin 60°j) and v = -4i + 4sqrt3j. Find u + v in component form, linear form, and trigonometric form.

WORK SPACE AND ANSWER

ANSWER KEY

Vector Shape Shift

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Rewrite <6,-8> in linear form.	**6i - 8j**
2	Rewrite -11i + 14j in component form.	**<-11,14>**
3	Rewrite 12(cos 30°i + sin 30°j) in linear form.	**6sqrt3i + 6j**
4	Rewrite 16(cos 120°i + sin 120°j) in component form.	**<-8,8sqrt3>**
5	Rewrite <-7,24> in trigonometric form.	**25(cos(180° - tan^{-1}(24/7))i + sin(180° - tan^{-1}(24/7))j)**
6	Rewrite 20(cos 225°i + sin 225°j) in linear form.	**-10sqrt2i - 10sqrt2j**

PART 2 · APPLY IT

1. **-8sqrt3i - 8j meters** Use cos 210° = -sqrt3/2 and sin 210° = -1/2, then multiply both values by 16.
2. **29(cos(180° - tan^{-1}(21/20))i + sin(180° - tan^{-1}(21/20))j) meters** The magnitude is sqrt((-20)^2 + 21^2) = 29. The vector is in Quadrant II, so theta = 180° - tan^{-1}(21/20).

CHALLENGE

Component form: <0,8sqrt3>; linear form: 8sqrt3j; trigonometric form: 8sqrt3(cos 90°i + sin 90°j)

Accept equivalent exact forms and coterminal direction angles in trigonometric answers. Accept 90° plus any whole-number multiple of 360° for the challenge direction angle.