Vectors and Art

Emil Dukovac

Kapuskasing District High School, Kapuskasing, Ontario

This material was used in a sample of 100 14-year-old students in Grade 9.

Materials: compass, ruler, grid paper.

Procedure:

1. On Diagram 1:
   (a) Draw the co-ordinate axes.
   (b) Draw a circle, centre at the origin, radius 8 units.
   (c) Plot the following ordered pairs and label them all A: A(8,0), A(0,8), A(7,4), A(4,7).

2. On Diagram 2:
   Reflect the ordered pairs labelled A in the x-axis; label them A.

3. On Diagram 3:
   Reflect all the ordered pairs marked A in the y-axis; label them A.

4. On Diagram 4:
   (a) Draw the vectors $\vec{AB} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$; A will be the initial point of $\vec{AB}$; B will be the terminal point of $\vec{AB}$.
   (b) Label the origin C(0,0); draw the vector $\vec{CD} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$.

5. On Diagram 5:
   Draw a series of parallelograms labelled ABDC; do this by joining all the segments labelled CA and DB.

6. How do you see the picture?

7. Note: the students do the above development on one graph.

Follow-Up Activities

1. Discuss symmetry in the origin.

2. Art Project -

   Use vectors to create an art piece. Give equal marks for (a) originality, (b) aesthetic qualities, (c) mathematical explanation.

3. Pythagorus -

Teacher: "Does A(4,7) really lie on the circle?"

Student: "No, it is off just a bit; I can tell by looking at my diagram."

Teacher: "How can we prove that A(4,7) does not lie on the circle?"

Student: "Find the length of CA."

Teacher: "How shall we find the $|CA|$?"

Student: "Use Pythagorus."

Solution:

$CA^2 = 4^2 + 7^2$

$CA^2 = 16 + 49$

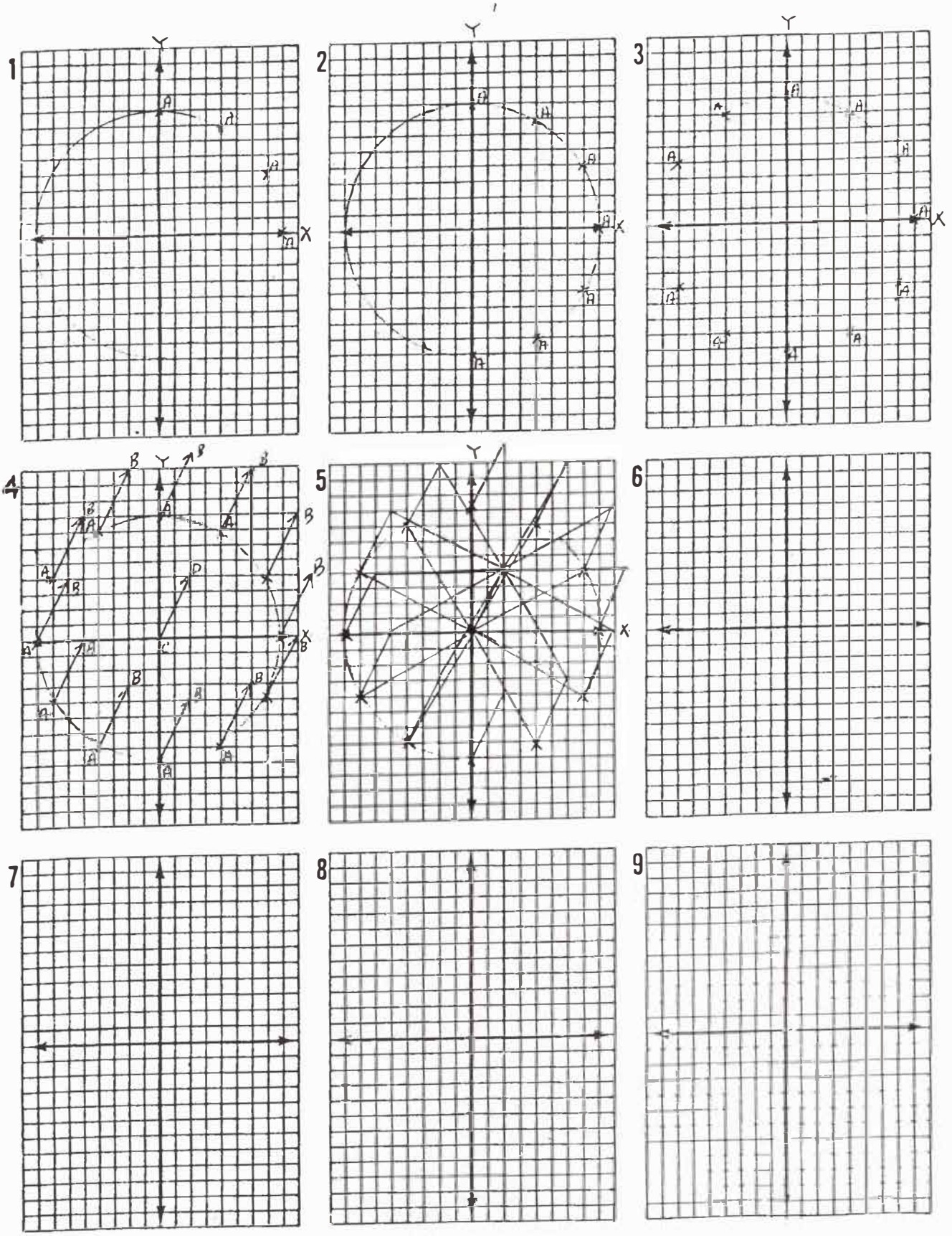
$CA^2 = 65$

$|CA| = \sqrt{65}$

but the radius of the circle is $8 = \sqrt{64}$

$\sqrt{65} > \sqrt{64}$

$\therefore$ A(4,7) is outside the circle.


1
2
3
4
5
6
7
8
9