Literacy T-Chart – 3-2-1

CIP 48.0501 Machine Tool Technology/Machinist

Identify multistep procedures and analyze results based on the text.

Program Task:	PA Core Standard: CC.3.5.11-12.C
502: Square a building using the 3-4-5 Pythagorean Theorem.	Description: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Program Associated Vocabulary:	Reading Associated Vocabulary:
Cartesian coordinates Polar coordinates Dimension Infinity Axis	Analyze Procedure Summarize

Program Strategy:	Literacy Strategy:
Use the 3-2-1 strategy to ensure students can identify critical information in a procedure and potential outcomes prior to attempting the procedure. After introducing the 3-2-1 strategy, present the following 3-2-1 prompts to students: 3- Identify three differences between Cartesian coordinates and polar coordinates. 2-Describe two ways that Cartesian and polar coordinates are similar. 1-Explain why you need to know both systems when working with CNC machines. Use an article such as the following one (Difference Between Cartesian Coordinates and Polar Coordinates) for students to locate the answers. If this isn't sufficient, you can direct them to other research or their experiences.	*Whole Group* Explain to students that developing the ability to identify key information during a process is a critical skill. The 3-2-1 strategy helps students pinpoint elements that they will need to remember and use. *Guided Practice* Show a brief passage electronically that all students can read, followed by 3-2-1 prompts. Read the passage aloud and model how you locate the answers to the prompts. Use content with which students should be familiar or a simple recipe so students can focus on the strategy rather than learning the content. Use prompts such as the following: 3 – What are the three steps? 2 – What two cautions are given? 1 – What is the one primary result that is expected?

Program Strategy:	Literacy Strategy:
Cartesian Coordinates vs Polar Coordinates In geometry, a coordinate system is a reference system, where numbers (or coordinates) are used to uniquely determine the position of a point or other geometric element in space. The coordinate systems allow the geometrical problems to be converted into a numerical problem, which provides the basis for analytic geometry. Cartesian coordinate system and the polar coordinate systems are two of the common coordinate systems used in mathematics. **Cartesian Coordinates** Cartesian coordinate system uses the real number line as the reference. In one dimension, the number line extends from negative infinity to positive infinity. Considering the point 0 as the start, the length to each point can be measured. This provides a unique way of identifying a position on the line, with a single number. The concept can be extended into two and three dimensions where number lines perpendicular to each other are used. They all share the same point 0 as the start. The number lines are termed as axes, and often called X axis, Y axis, and Z axis. The distance to a point along each axis starting from (0, 0, 0), which is also known as the origin, and given as a tuple is known as the coordinate of the point. A general point in this space can be represented by the coordinate (x,y,z). In a plane system where there are only two axes, coordinates are given as (x,y). A plane created by the axes are known as a Cartesian plane, and often referred to by the letters of the axes (e.g., XY plane). This general point can be used to describe different geometrical elements by constraining the general point to behave in specific ways. For example, equation x^2+y^2=a^2 represents a circle. Rather than drawing a circle with radius *a* it is possible to denote the circle with more abstract way shown above. **Polar Coordinates** Polar coordinates use a different reference system to denote a point. Polar coordinates system uses the counter clockwise angle from the positive direction of x axis and the straight line distance to the point as the coordinates. The polar coordinates can be represented as above in the two-dimensional Cartesian coordinates system.	Point out that this is a form of summarizing information without writing a paragraph. *Application* Provide students with a text that gives a process that students need to apply. After giving them time to read the material, give your prepared 3-2-1 prompts to be completed accurately before they are allowed to perform the procedure. Review answers with students either individually, in teams or with the whole class to ensure maximum understanding of the content. In debriefing, use the following questions: • How did you find the answers to the prompts? • Why did the final prompt that asked for one thing take more thinking? • Why is it important to be able to answer questions like these? Listen for: • Lower level prompts can be answered with just locating information. • Higher levels require some inference or combining information. • If you do not understand the processes and possible outcomes before starting, errors may occur.

Program Strategy:	Literacy Strategy:
The transformation between polar and Cartesian systems is given by following relations: $r = \sqrt{(x^2 + y^2)} \quad \leftrightarrow \quad x = r \cos\theta,\ y = r \sin\theta$ $\theta = \tan^{-1}(x/y)$ **What is the difference between Cartesian and Polar Coordinates?** • Cartesian coordinates use number lines as the axes, and it can be used in one, two or three dimensions. Therefore, it has the ability to represent linear, planar, and solid geometries. • Polar coordinates use an angle and a length as the coordinates, and it can represent only linear and planar geometries, though it can be developed into cylindrical coordinates system, to represent solid geometries. • Both systems are used to represent imaginary numbers by defining the imaginary axis, and play a vital role in complex algebra. Though, in the plain form, Cartesian coordinates are real numbers (x,y,z) the coordinates in the polar system are not always real numbers; i.e. if the angle is given in degrees, coordinates are not real; if the angle is given in radians coordinates are real numbers. After students answer the prompts individually, have them share with a partner or team to confirm their answers. Follow with a whole-class discussion to clarify any misconceptions. Students can submit their answers as an exit slip for formative assessment.	

Instructor's Script – 3-2-1

3-2-1 gives students a scaffold to identify what is important to know. It ensures that students have good notes about a topic they need to understand at a deeper level.

Common Mistakes Made by Students

Students often expect to be able to answer questions by quick reading and looking for key words. If 3-2-1 prompts are constructed properly, students will need to make inferences and may have to re-read information to answer the two higher levels of questions. They must still give answers that are grounded in the text.

CTE Instructor's Extended Discussion

CNC machining requires technicians to do more than follow rote procedures. Even though procedures may be stated as step-by-step, they need to understand the background concepts. The 3-2-1 strategy provides support for identifying key information to be able to complete these tasks.

While Cartesian and polar coordinate systems are mathematical concepts, reading can be used to understand and apply the mathematics.

Sample Questions

Career and Technical Concepts

Question	Answer
Read the following short passage and answer the question that follows. By now you would have seen X, Y and Z coordinates mentioned everywhere. They refer to the planes or axes of movement of a CNC machine. In simple terms, they mean: X axis = Left and right movement Y axis = Forward and backward movement Z axis = Up and down vertical movement What is a possible consequence of confusing the X, Y and Z axes? A. The CNC machine will not be affected. B. Cuts will be at wrong depths. C. The CNC machine will stop. D. The CNC machine will break.	B. Cuts will be at wrong depths.

PA Core Reading Concepts

Question	Answer
Read the information below and answer the question that follows: Accuracy refers to the closeness of a measured value to a standard or known value. For example, if in lab you obtain a weight measurement of 3.2 kg for a given substance, but the actual or known weight is 10 kg, then your measurement is not accurate. In this case, your measurement is not close to the known value. How could the described inaccurate measurement impact the experiment? A. Results will not be correct. B. New measurement tools need to be found. C. The experiment needs to be scrapped. D. The standards need to be changed.	A. Results will not be correct.