# Weems \& Plath ${ }^{\circledR}$ Proportional Dividers 

## For Computing:

## Speed

Time Distance


## Weems \& Plath

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The Weems \& Plath ${ }^{\circledR}$ Dividers constitute a universal device for solving speed-time-distance relations, whether in air navigation or marine navigation. The instrument is equally suitable for use with statute miles or nautical miles. It is only necessary to remember that the answer is in the same terms as the given data.

The Weems \& Plath ${ }^{\circledR}$ Dividers are exactly the same as the proportional dividers long used by draftsmen and chart makers, except that they have additional scales reading directly in units of speed or time.

The Dividers consist of a pair of slotted legs to each of which is attached a "long point" at one end and a "short point" at the other end. The two legs are held together by a slider with a thumb screw for clamping it in position. On the inside of one leg is a small projection. On the other leg is a corresponding slot into which the projection fits when the legs are in the closed position. One leg carries a scale marked from 6 to 60 , the word "DISTANCE" with an arrow pointing toward the short point, and the words "SPEED or TIME (MIN)" with an arrow pointing toward the long point. The other leg carries a scale marked form 60 to 600, the words "SPEED or TIME (MIN)" with an arrow pointing toward the short point, and the word "DISTANCE" with an arrow pointing toward the long point. This leg also carries the standard draftsman's ratio scale from 1 to 10 . On each side of the slider is engraved an index line and the words "TIME (MIN) or SPEED".

## INSTRUCTIONS FOR USE

With any two of the three quantities, speed, time and distance given, the third can be found by use of these dividers and a linear scale such as the distance scale on a chart or plotting sheet. Any convenient scale can be used as long as the same scale units are employed for measuring with the long and short points of the dividers.

There are three steps in solving a problem:

1. Set slider to one of the known quantities on divider scale.
2. Open divider legs until one set of points measures the other known quantity on any convenient linear scale.
3. Read unknown quantity between other set of divider points on same linear scale.

The scales on the divider may be used for either speed or time, never for distance. Hence, if distance is given, the slider index must be set to the point on the scale corresponding to the other given quantity, either speed or time. If speed and time are given, either one may be set on the divider scale, giving a choice of two methods of working the problem. This setting is made by closing the divider legs and moving the slider until the appropriate index line is on the point of the scale corresponding to the given speed or time.

CAUTION: It is of the utmost importance that the legs be closed, with the projection well seated in the slot, whenever the slider is being adjusted to a setting on the divider scale. After making such a setting, clamp the slider in position, not too tight to permit the legs to open, but tight enough to prevent motion of the slider along the slots after the legs are opened.

Always use time in minutes, whether more or less than one hour.

By following the wording engraved on these dividers, it is not necessary to remember rules for their use. However, such rules may be stated as follows:

1. When a time or a speed of less than 60 is set on the divider scale, the short points measure distance and the long points measure the third quantity.
2. When a time or a speed of more than 60 is set on the divider scale, the long points measure distance and the short points measure the third quantity.

The following Examples will illustrate the use of these dividers:
Example 1: At an estimated ground speed of 120 miles per hour, how long should it take to reach a check point 48 miles from point of departure?
a. With the dividers in closed position, set the slider index at 120 on the divider scale and clamp lightly in position.
b. Open the divider legs and place the long points 48 units apart by use of the chart distance scale (or any other convenient scale, such as the one on the Weems Mark II plotter). See figure 2A. NOTE: The long points are used for distance since the speed, set on the divider scale, is greater than 60 . Also notice that on the same side as the 120 scale marking is found the word "DISTANCE" and an arrow pointing to the long points.
c. By use of the same scale, measure the distance between the short points of the dividers. See Fig. 2B. It is found to be 24 units. Therefore, the estimated time required to reach the check point is 24 minutes.


FIG. 2A


## WHEN USED DIRECTLY ON A CHART

It is, however, not even necessary to know that the next check point is 48 miles away. Merely open the dividers and place the long points on the point of departure and the next check point. The short points are automatically positioned for measuring the time of 24 minutes from the chart distance scale.

Example 2: The airplane, in Example 1, actually reached the check point 48 miles away in 25 minutes. What was the ground speed made good?
a. With the divider in closed position, set the slide index at 25 on the divider scale and clamp lightly in position.
b. Open the divider legs and place the short points 48 units apart by use of any convenient scale. NOTE: The short points are used for distance since the time, set on the divider scale, is less than 60 . Also notice that on the same side as the 25 scale marking is found the word "DISTANCE" and an arrow pointing to the short points.
c. By use of the same scale, measure the distance between the long points of the dividers. It is found to be 115 units. Therefore, the ground speed made good was 115 m.p.h..

Again, it is not necessary to know the distance traveled. You know that it took 25 minutes to fly between 2 points on the chart. Place the short points on the two positions and read ground speed from the chart scale as the distance between long points.

Example 3: How far will a ship travel in 1 hour and 20 minutes if its speed is 15 knots?

This is a case where both speed and time are given and hence, either one may be set on the divider scale.

First Method:
a. Set slider index at 80 ( 1 hr .20 min . equals 80 minutes).
b. Place short points 15 units apart on any convenient scale.
c. By use of the same scale, measure the distance between the long points. It will be 20 units. Therefore, the required distance is 20 miles.

If the scale used in (b) above is the chart distance scale it is not necessary to determine that the distance is 20 miles. From your present location, merely place the long points along your course line to determine where on the chart you should be at the end of 80 minutes time.

Second Method:
a. Set slider index at 15 .
b. Place long points 80 units apart on any convenient scale.
c. By use of the same scale, measure the distance between the short points. It will be 20 units. Therefore, the distance required is 20 miles.

Proportional Dividers are in effect, a slide rule on which any proportions can be solved. The engraved scales cover from 6 to 600 . For higher or lower numbers, the slide rule principle of moving the decimal point applies. For example, at a speed of 700 mph , drop the zero and use 70 , dropping a zero from the answer also. This principle is useful when approaching the extremity of the scale. At 550 knots the spread between the short points may not be great enough for desired accuracy. In this case, by dropping a zero and using 55 , you can often obtain better accuracy. Likewise, for a small boat at 4 knots, use 40 and add a zero to your answer.

## USE AS ORDINARY PROPORTIONAL DIVIDERS

A simple ration scale, from 1 to 10 , is provided on one leg of these dividers. This scale is used in the same manner as the ratio scale on standard proportional dividers commonly used by draftsmen and others.

