

Chapter 8 – Folded Scales (CD, DF, and CIF)

8.1 The Form of the Folded Scales

The CF and DF scales are identical with the C and D scale, except they are displaced by a factor of π . The CF and DF scales could be constructed by cutting the C and D scales at π (i.e. 3.1416 . . .) and joining the two sections with the left and right indices (i.e. 1 and 10) together. The CIF is the inverted or reciprocal scale in relation to the CF scale.

8.2 Multiplication and Division (CF, CIF, DF scales)

If either index of the C scale is set over a number on the D scale, then the index (“1”) of the CF scale will be opposite the same number on the DF scale. This allows us to either use the CF and DF scales by themselves for multiplication, or in combination the C and D scales.

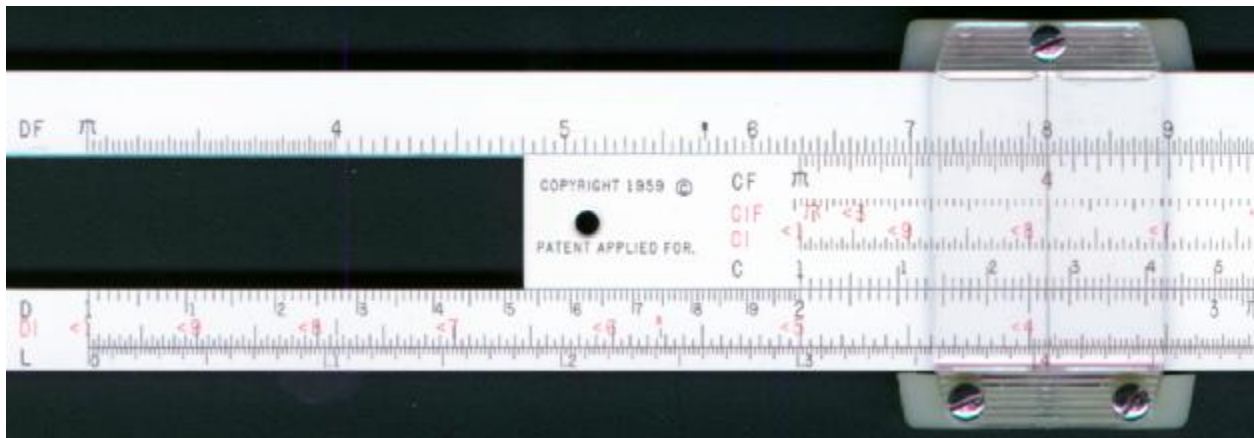


Fig 8-1

Example 1: $2 \times 4 = 8$ (Fig. 8-1)

1. Place the left index of the C scale over the 2 on the D scale.
2. Set the hair line over the 4 on the CF scale.
3. Under the hair line read off 8 on the DF scale as the answer.

Example 2: $3 \times 9 = 27$

To calculate this problem on the C and D scales alone, you will note it would require that the right index of the C scale to be set over the 3 on the D scale. Thus if we wished to place the left index of the C scale over the 3 on the D scale, 9 of the C scale would be off the end of the D scale. However, using the CF and DF scales, we could do the following.

1. Place the left index of the C scale over the 3 on the D scale.
2. Set the hair line over 9 on the CF scale.
3. Under the hair line read off 27 on the DF scale as the answer.

Exercise 8(a)

Use the left index of the C scale and read the answer off the DF scale for the following.

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|----------------------|--------------------------|
| (i) $2 \times 8 =$ | (iii) $3.1 \times 7.5 =$ |
| (ii) $16 \times 9 =$ | (iv) $27.4 \times 6.1 =$ |

To multiply using the CF and DF scales only:

Example: $9 \times 8 = 72$

1. Place the index of the CF scale on the 9 of the DF scale.
2. Set the hair line over the 8 on the CF scale.
3. Under the hair line read off 72 on the DF scale as the answer.

The above multiplication can be done also by using the CIF and DF scales in exactly the same way as previously with the CI and D scales.

1. Set the hair line over 9 on the DF scale.
2. Place the 8 of the CIF scale under the hair line.
3. Above the index of the CF scale, read off 72 on the DF scale as the answer.

To divide using the CF and DF scales only:

Example: $56 \div 7 = 8$

1. Set the hair line over 56 on the DF scale.
2. Place the 7 of the CF scale under the hair line.
3. Above the index of the CF scale, read off 8 as the answer on the DF scale.

The above division can also be done using the CIF and D scales with the same procedure as used previously with the CI and D scales. (fig 8-6)

1. Place the index of the CF scale under the 56 on the DF scale.
2. Set the hair line over the 7 on the CIF scale.
3. Under the hair line read off 8 on the DF scale as the answer.

Note:

- (a) For practicing the above multiplication and division, use the exercises in units 2 and 3.
- (b) For combinations of these methods of multiplication and division, with those previously used, see unit 10.

8.3 Multiplication and Division by π .

Because the CF and DF scales are displaced by π in respect to the C and D scales, we can very easily multiply or divide by π as follows.

Example 1: $1.45 \times \pi = 4.56$

1. Set the hair line over 1.45 on the D scale.
2. Under the hair line read off 4.56 on the DF scale as the answer.

Conversely, for $4.56 \div \pi = 1.45$ we could:

1. Set the hair line over 4.56 on the DF scale.
2. Under the hair line read off 1.45 on the D scale as the answer.

Example 2: $1.41^2 \times \pi = 6.15$

1. Place the left index of the C scale over 1.4 on the D scale.
2. Set the hair line over 1.4 on the C scale. (note: This would give 1.4^2 on the D scale under the hair line).
3. Under the hair line read off 6.15 on the DF scale as the answer.

Note: We have multiplied 1.4^2 by π in reading the answer of the DF scale instead of the D scale.

Example 3: $\frac{8.3}{6.85 \times \pi} = 0.386$

1. Set the hair line over 8.3 on the DF scale. (Note: under the hair line on the D scale we have $8.3 \div \pi$).
2. Place the 6.85 of the C scale under the hair line.
3. Below the right index of the C scale read off 0.386 on the D scale as the answer.

Exercise 8(b)

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|--------------------------------------|---|
| (i) $3.6 \times \pi =$ | (vi) $\pi \times 6.3 \times 5.4 =$ |
| (ii) $7.9 \div \pi =$ | (vii) $\frac{24.6}{12.68 \times \pi} =$ |
| (iii) $\frac{4.8 \times \pi}{2.6} =$ | (viii) $\frac{17.2}{\pi \times 7.45} =$ |
| (iv) $\frac{\pi \times 8.3}{17.1} =$ | |
| (v) $\pi \times 1.5^2 =$ | |

8.4 Miscellaneous Problems

Exercise 8(c)

- (i) Find the circumferences of circles with the following diameters: 2.6, 45.5 and 15.2.
- (ii) Find the diameter of circles with the following circumferences: 6.6, 15.6 and 88.
- (iii) Find the area, A, of a circle, when $r = 4.1\text{cm}$, for $A = \pi r^2$.
- (iv) The volume of a cylinder is given by $V = \pi r^2 h$. Find V for $r = 6.2$ and $h = 10.8$.
(Hint: This can be done with one setting of the slide by using CI, C, D and DF scales.)
- (v) The area of an ellipse is $A = a \times b \times \pi$. Find for $a = 3.2$ and $b = 2.6$.
- (vi) For the length of an arc $S = \frac{r\pi\theta}{180}$, calculate S for $\theta = 35.2^\circ$ and $r = 26.2$.
- (vii) The area of a sector of a circle, A, is given by $A = \frac{r^2\pi\theta}{2 \times 180}$. Find the area if $r = 6.3$ and $\theta = 48^\circ$.

Answer to 8(c)(vi)

