

## 7-6 Common Logarithms

- solve exponential equations and inequalities using common logarithms
- evaluate logarithmic expressions using Change of Base Formula.
- A.CED.1

**Common Logarithms:** logarithms that have base 10.

- written without the base subscript:

$$10^? = 5$$

- used in everyday formulas:

- pH levels of a substance:

- pH levels of blood:  $\text{pH} =$

- loudness (in decibels):  $L = 10 \log$

$$\rightarrow L = 10 \log\left(\frac{I}{I_0}\right)$$

**Use a calculator to evaluate common logs**

1.  $\log 6$

$$0.7781$$

$$10^? = 6$$

2.  $\log .35$

$$-0.4559$$

$$10^? = .35$$

$$10^0 = 1$$

3.  $\log(1/2)$

$$-0.3010$$

**Solving with common logs**

- used to solve exponential equations that cannot be written as a common base.

*Property of Equality:* If  $b^y = x$ , then  $\log b^y = \log x$

Solve the following equations and inequalities.

$2x=10$

1.  $3^x=11$   
 $\log 3^x = \log 11$   
 $x \cdot \frac{\log 3}{\log 3} = \frac{\log 11}{\log 3}$   
 $x \approx 2.1827$

2.  $5^x=62$   
 $\log 5^x = \log 62$   
 $x \cdot \frac{\log 5}{\log 5} = \frac{\log 62}{\log 5}$   
 $x \approx 2.5643$

3.  $7^{t-2}=5^t$   
 $\log 7^{(t-2)} = \log 5^t$   
 $\frac{(t-2) \cdot \log 7}{\log 7} = \frac{t \cdot \log 5}{\log 7}$   
 $t-2 = 0.8271t$   
 $-t \quad \quad t$   
 $-2 = -0.1729t$   
 $11.5665 \approx t$

4.  $2^{7x} > 3^{5x-3}$   
 $\log 2^{7x} > \log 3^{(5x-3)}$   
 $\frac{7x \cdot \log 2}{\log 3} > \frac{(5x-3) \cdot \log 3}{\log 3}$   
 $4.4165x > 5x-3$   
 $-5x \quad -5x$   
 $-0.5835x > -3$   
 $x < 5.1415$

## Changing of a base

- used to change any base to a different base, preferably base 10.
- change of base formula: where  $a$  is the original base and  $b$  is the new desired base:

Express the following logarithms as a common logarithm. Then give the decimal approximate.

1.  $\log_3 18$

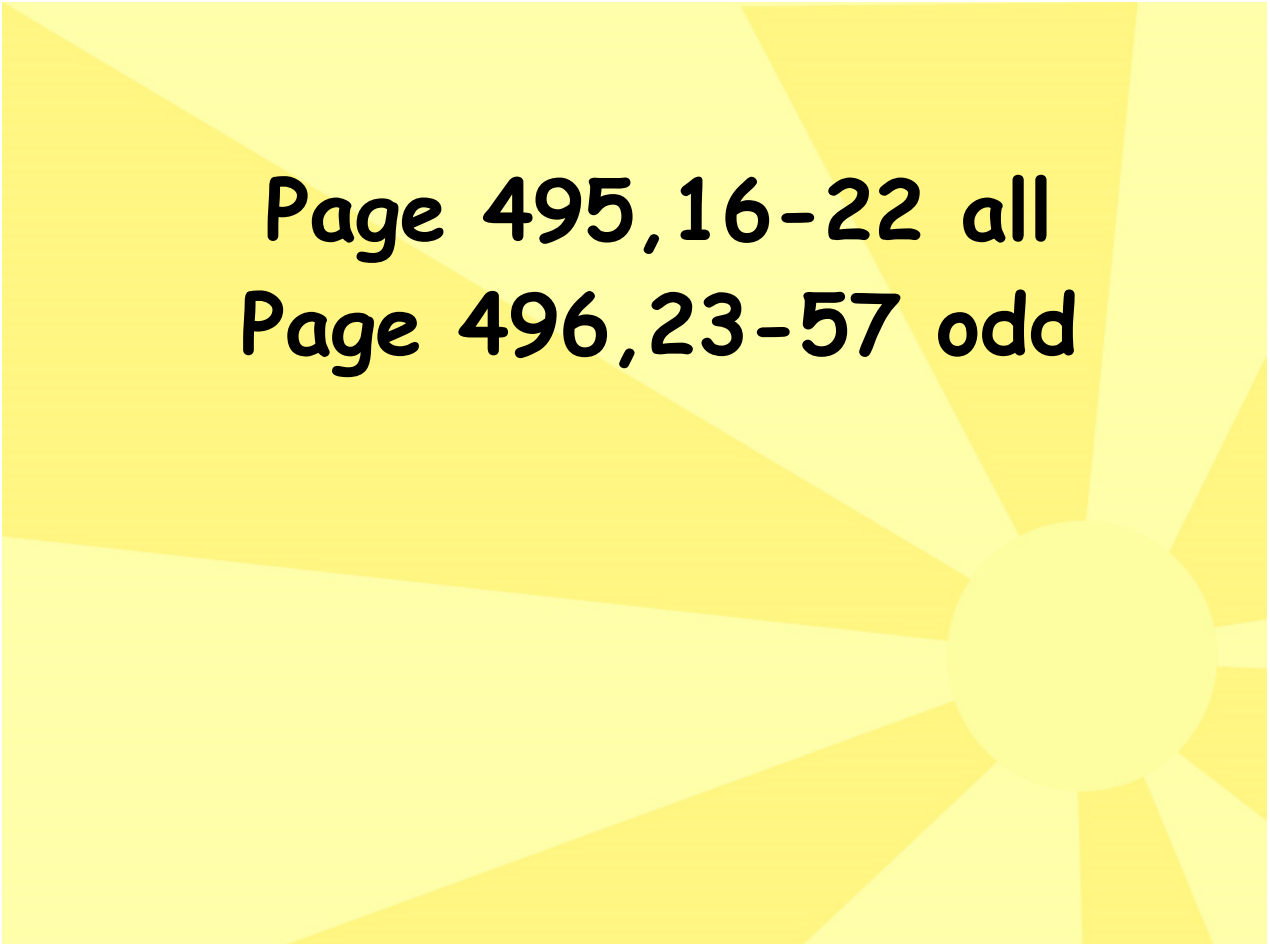
$$\frac{\log 18}{\log 3} \approx 2.6309$$

2.  $\log_7 5$

$$\frac{\log 5}{\log 7} \approx 0.8451$$

3.  $\log_2 45$

$$\frac{\log 45}{\log 2} \approx 5.1520$$

A yellow sunburst graphic with a central circle and rays extending outwards, set against a white background.

**Page 495,16-22 all**  
**Page 496,23-57 odd**