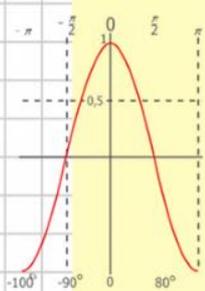
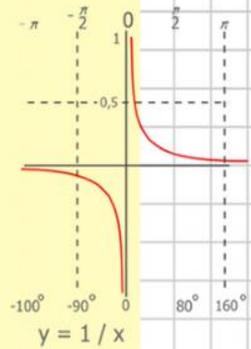
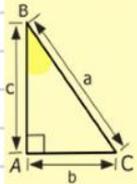
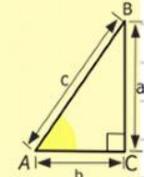
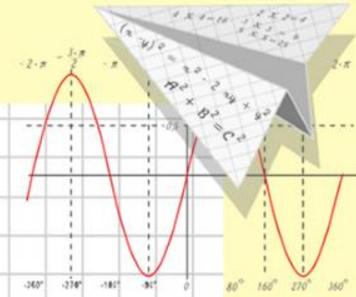
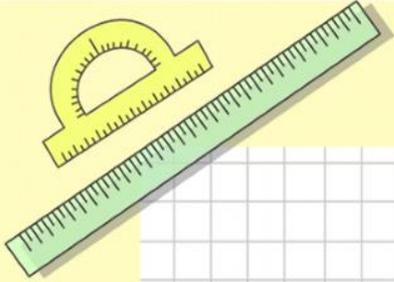


# Математика

## Решение показательных уравнений.



$$\begin{array}{r} \frac{1}{2} 500 \\ \times 42 \\ \hline 210 \\ + 84 \\ \hline 10500 \end{array}$$

$$y = \cos x$$
$$\begin{array}{l} 2 \times 2 = 4 \\ 3 \times 3 = 9 \\ 4 \times 4 = 16 \\ 5 \times 5 = 25 \\ 6 \times 6 = 36 \\ 7 \times 7 = 49 \\ 8 \times 8 = 64 \end{array}$$

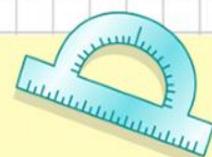


$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

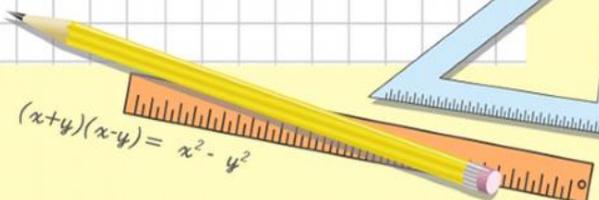
$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$



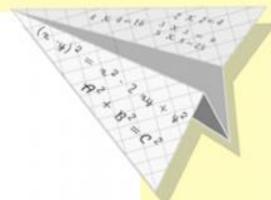
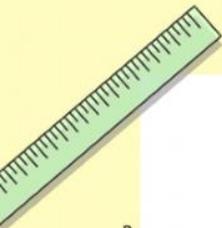
$$\sin 90^\circ = 1$$



$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$
$$\begin{cases} y = 1 \\ x = 25 + 45 \\ \hline x = 70 \end{cases}$$

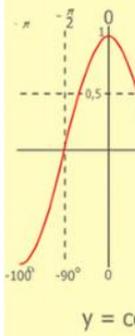
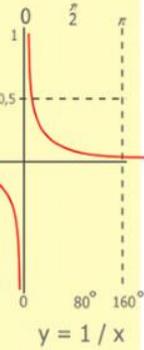
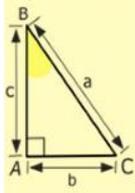
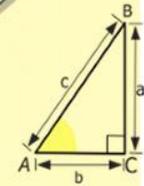


$$(x+y)(x-y) = x^2 - y^2$$



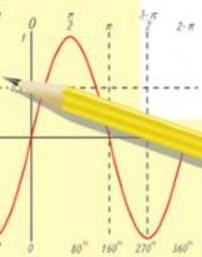
**Расскажи – и я забуду,  
Покажи – и я запомню,  
Дай мне сделать самому – и я научусь!**

**Китайская мудрость**



$$\begin{array}{r} 1 \\ \times 2500 \\ \hline 2500 \\ + 42 \\ \hline 210 \\ + 84 \\ \hline 105000 \end{array}$$

- 2 x 2 = 4
- 3 x 3 = 9
- 4 x 4 = 16
- 5 x 5 = 25
- 6 x 6 = 36
- 7 x 7 = 49
- 8 x 8 = 64
- 9 x 9 = 81



$$\frac{a}{A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

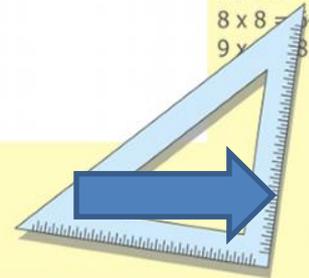
$\sin 90^\circ = 1$



$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

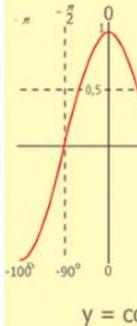
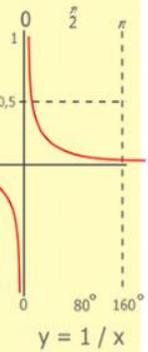
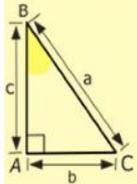
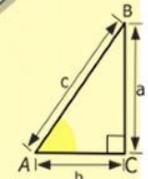
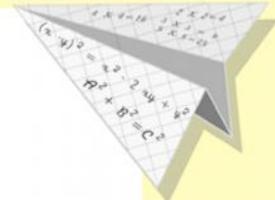
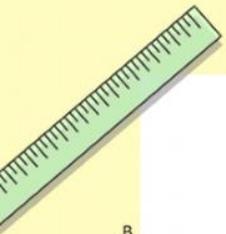
$$\begin{cases} y = 1 \\ x = 25 + 45 \\ \hline x = 70 \end{cases}$$

$(x+y)(x-y) = x^2 - y^2$



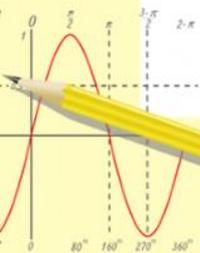
# Определение

Уравнение, в котором переменная содержится в показателе степени, называется **показательным**.



$$\begin{array}{r} \frac{1}{2} 500 \\ \times 42 \\ \hline 210 \\ + 84 \\ \hline 105000 \end{array}$$

- $2 \times 2 = 4$
- $3 \times 3 = 9$
- $4 \times 4 = 16$
- $5 \times 5 = 25$
- $6 \times 6 = 36$
- $7 \times 7 = 49$
- $8 \times 8 = 64$
- $9 \times 9 = 81$



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

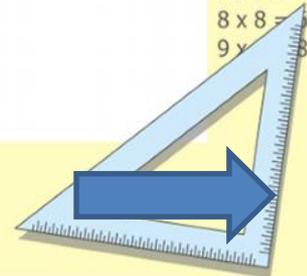
$$\sin 90^\circ = 1$$



$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

$$\begin{cases} y = 1 \\ x = 25 + 45 \\ \hline x = 70 \end{cases}$$

$$(x+y)(x-y) = x^2 - y^2$$

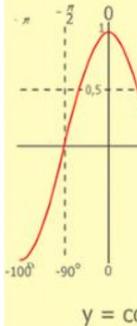
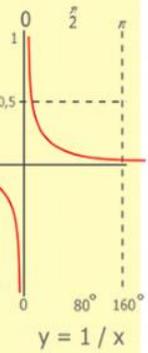
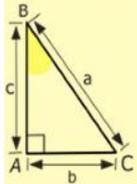
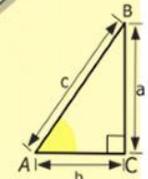
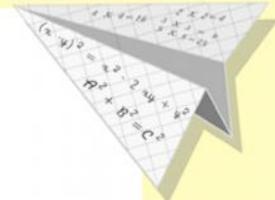
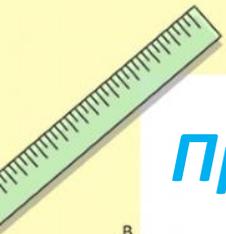


Простейшим показательным уравнением является уравнение вида

$$a^x = a^b, \text{ где } a > 0, a \neq 1.$$

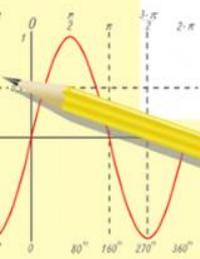
Простейшее показательное уравнение решается с использованием свойств степени.

$$a^x = a^b \Leftrightarrow x = b$$



$$\begin{array}{r} \frac{1}{2} 500 \\ \times 42 \\ \hline 210 \\ + 84 \\ \hline 10500 \end{array}$$

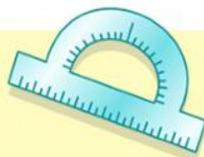
$2 \times 2 = 4$   
 $3 \times 3 = 9$   
 $4 \times 4 = 16$   
 $5 \times 5 = 25$   
 $6 \times 6 = 36$   
 $7 \times 7 = 49$   
 $8 \times 8 = 64$   
 $9 \times 9 = 81$



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

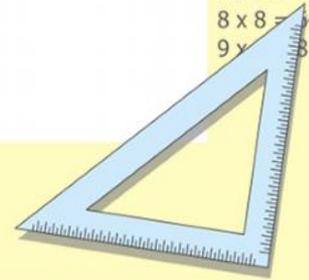
$$\sin 90^\circ = 1$$



$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

$$\begin{cases} y = 1 \\ x = 25 + 45 \\ \hline x = 70 \end{cases}$$

$$(x+y)(x-y) = x^2 - y^2$$



$$1) a^0 = 1$$

$$2) a^1 = a$$

$$3) a^m \cdot a^n = a^{m+n}$$

$$4) \frac{a^m}{a^n} = a^{m-n}; \text{ zde } a \neq 0$$

$$5) (a^m)^n = a^{m \cdot n}$$

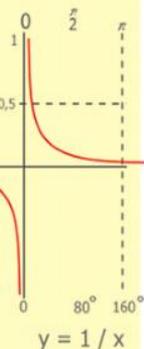
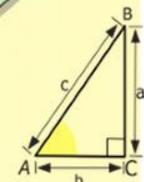
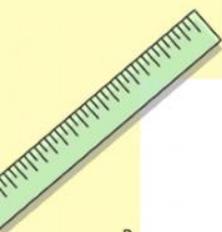
$$6) (ab)^n = a^n \cdot b^n$$

$$7) \left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}; \text{ zde } b \neq 0$$

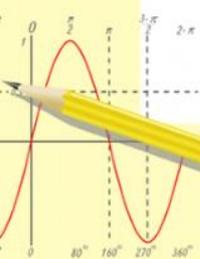
$$8) a^{-n} = \left(\frac{1}{a}\right)^n = \frac{1}{a^n}; \text{ zde } a \neq 0$$

$$9) \left(\frac{1}{a}\right)^{-n} = \frac{1}{a^{-n}} = a^n; \text{ zde } a \neq 0$$

$$10) \left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n = \frac{b^n}{a^n}; \text{ zde } a \neq 0 \text{ u } b \neq 0.$$



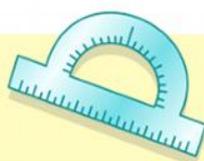
$$\begin{array}{r} 1 \\ 2500 \\ \times 42 \\ \hline 210 \\ + 84 \\ \hline 10500 \end{array}$$



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

$$\sin 90^\circ = 1$$

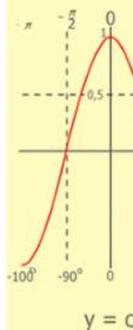
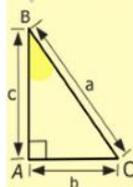
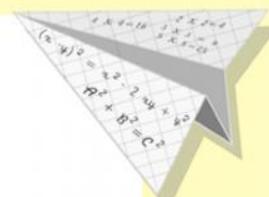


$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

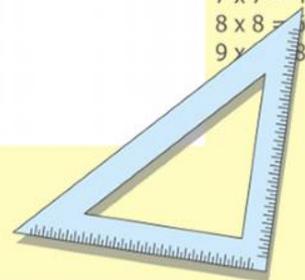
$$\begin{cases} y = 1 \\ x = 25 + 45 \end{cases}$$

$$x = 70$$

$$(x+y)(x-y) = x^2 - y^2$$



$$\begin{array}{l} 2 \times 2 = 4 \\ 3 \times 3 = 9 \\ 4 \times 4 = 16 \\ 5 \times 5 = 25 \\ 6 \times 6 = 36 \\ 7 \times 7 = 49 \\ 8 \times 8 = 64 \\ 9 \times 9 = 81 \end{array}$$

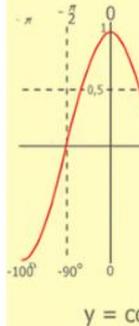
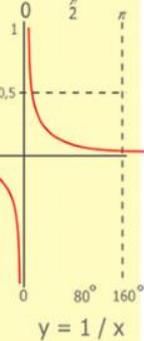
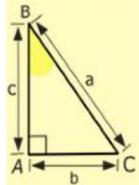
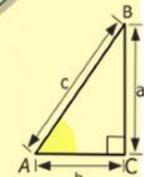
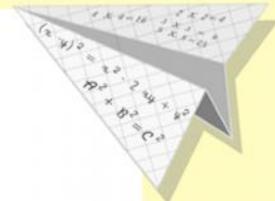
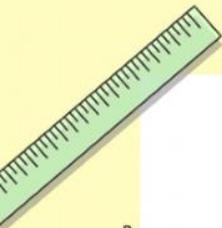


# Метод замены переменной

Показательное уравнение сводится к решению квадратного.

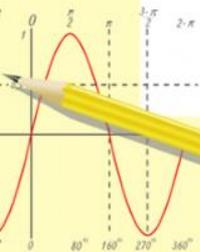
Способы замены используют, если:

- 1) основания степеней одинаковы;
- 2) показатель одной из степеней в 2 раза больше, чем другой. Например:  $9^x - 8 \cdot 3^x = 9$ ;
- 3) коэффициенты перед переменной противоположны. Например:  $2^{2-x} - 2^{x-1} = 1$ .



$$\begin{array}{r} 1 \\ \times 42 \\ \hline 210 \\ + 84 \\ \hline 10500 \end{array}$$

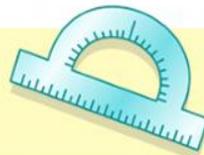
$$\begin{array}{l} 2 \times 2 = 4 \\ 3 \times 3 = 9 \\ 4 \times 4 = 16 \\ 5 \times 5 = 25 \\ 6 \times 6 = 36 \\ 7 \times 7 = 49 \\ 8 \times 8 = 64 \\ 9 \times 9 = 81 \end{array}$$



$$\frac{a}{A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

$$\sin 90^\circ = 1$$

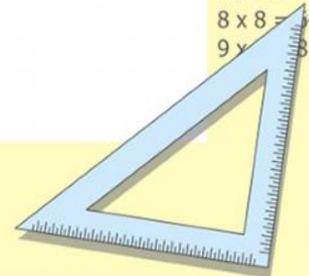


$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

$$\begin{cases} y = 1 \\ x = 25 + 45 \end{cases}$$

$$x = 70$$

$$(x+y)(x-y) = x^2 - y^2$$



# Решим уравнения

$$9^x - 8 \cdot 3^x = 9$$

$$3^{2x} - 8 \cdot 3^x - 9 = 0$$

$$3^x = t, (t > 0)$$

$$t^2 - 8 \cdot t - 9 = 0$$

$$D = 64 + 36 = 100$$

$$t_1 = \frac{8 + 10}{2} = 9$$

$$t_2 = \frac{8 - 10}{2} = -1, \text{ не подходит усл. } t > 0$$

$$3^x = 9$$

$$3^x = 3^2$$

$$x = 2$$

Ответ :  $x = 2$

$$\frac{a}{A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

$$\sin 90^\circ = 1$$

$$2^{2-x} - 2^{x-1} = 1$$

$$2^2 \cdot 2^{-x} - 2^x \cdot 2^{-1} = 1$$

$$\frac{4}{2^x} - \frac{2^x}{2} - 1 = 0$$

$$2^x = t, (t > 0)$$

$$\frac{4}{t} - \frac{t}{2} - 1 = 0 / \cdot (-2t)$$

$$t^2 + 2t - 8 = 0$$

$$D = 4 + 32 = 36$$

$$t_1 = \frac{-2 + 6}{2} = 2$$

$$t_2 = \frac{-2 - 6}{2} = -4 \text{ не подходит усл. } t > 0$$

$$2^x = 2$$

$$x = 1$$

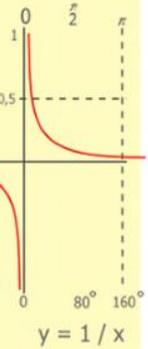
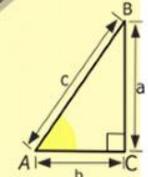
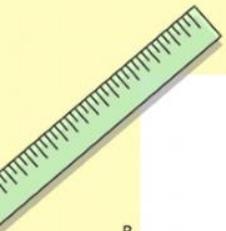
Ответ :  $x = 1$

$$\begin{cases} x=25y+45 \\ y=1 \end{cases}$$

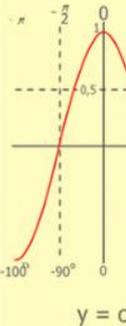
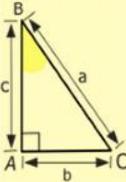
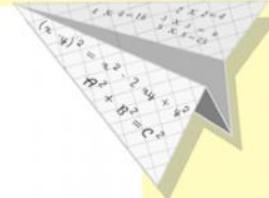
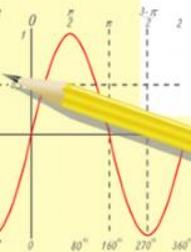
$$\begin{cases} y=1 \\ x=25+45 \end{cases}$$

$$x=70$$

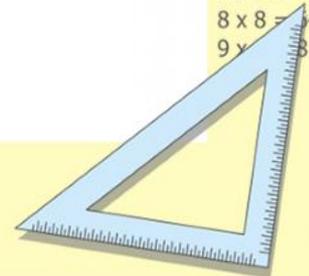
$$(x+y)(x-y) = x^2 - y^2$$



$$\begin{array}{r} 12500 \\ \times 42 \\ \hline 210 \\ + 84 \\ \hline 105000 \end{array}$$



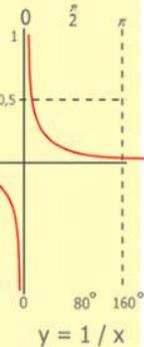
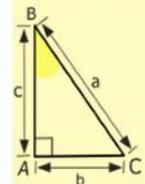
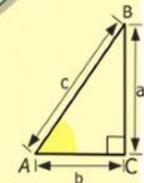
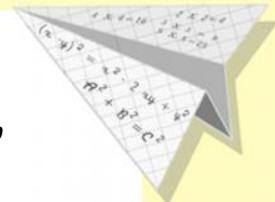
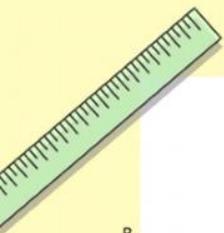
- 2 x 2 = 4
- 3 x 3 = 9
- 4 x 4 = 16
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- 6 x 6 = 36
- 7 x 7 = 49
- 8 x 8 = 64
- 9 x 9 = 81



# Решить самостоятельно:

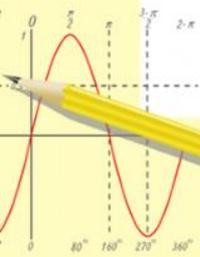
$$4^{2x} - 3 \cdot 4^x - 4 = 0$$

$$3^{2x} - 24 \cdot 3^x - 81 = 0$$



$$\begin{array}{r} \frac{1}{2} 500 \\ \times 42 \\ \hline 210 \\ + 84 \\ \hline 105000 \end{array}$$

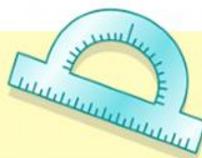
- $2 \times 2 = 4$
- $3 \times 3 = 9$
- $4 \times 4 = 16$
- $5 \times 5 = 25$
- $6 \times 6 = 36$
- $7 \times 7 = 49$
- $8 \times 8 = 64$
- $9 \times 9 = 81$



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

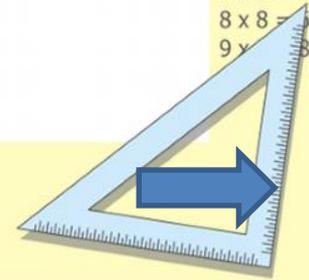
$$\sin 90^\circ = 1$$



$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

$$\begin{cases} y = 1 \\ x = 25 + 45 \\ \hline x = 70 \end{cases}$$

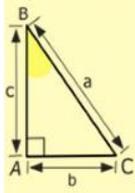
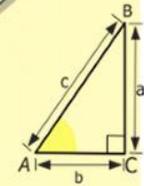
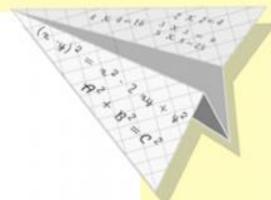
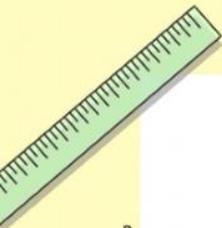
$$(x+y)(x-y) = x^2 - y^2$$



# Примеры:

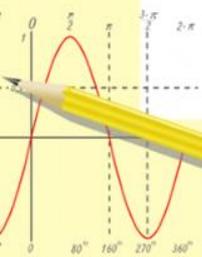
$$4^{x+2} - 4^{x+5} = -252$$

$$2^{3x+2} - 2^{3x-2} - 2^{3x-1} = 208$$



$$\begin{array}{r} 2500 \\ \times 42 \\ \hline 2100 \\ + 840 \\ \hline 105000 \end{array}$$

- 2 x 2 = 4
- 3 x 3 = 9
- 4 x 4 = 16
- 5 x 5 = 25
- 6 x 6 = 36
- 7 x 7 = 49
- 8 x 8 = 64
- 9 x 9 = 81



$$\frac{a}{A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

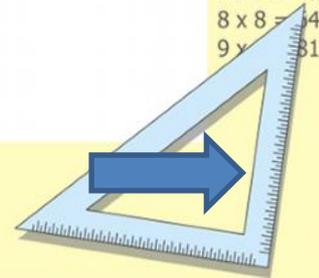
$$\sin 90^\circ = 1$$



$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

$$\begin{cases} y = 1 \\ x = 25 + 45 \\ \hline x = 70 \end{cases}$$

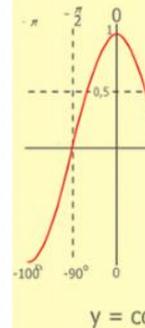
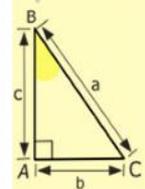
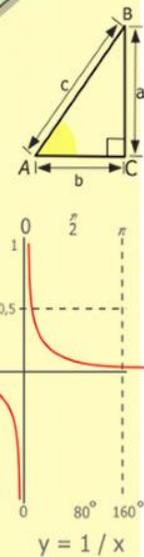
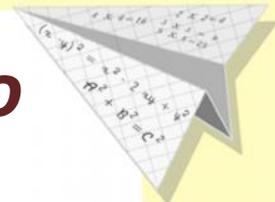
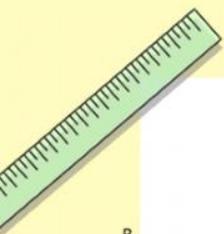
$$(x+y)(x-y) = x^2 - y^2$$



# Деление на показательную функцию

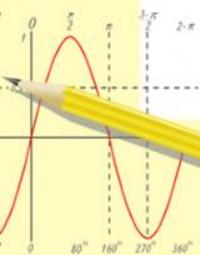
Этот способ используется, если основания степеней разные:

- а) в уравнении вида  $a^x = b^x$  делим на  $b^x$   
Например:  $4^x = 7^x \mid : 7^x$



$$\begin{array}{r} \frac{1}{2} 500 \\ \times 42 \\ \hline 2100 \\ + 84 \\ \hline 105000 \end{array}$$

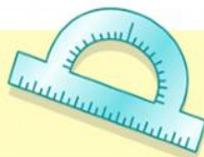
$$\begin{array}{l} 2 \times 2 = 4 \\ 3 \times 3 = 9 \\ 4 \times 4 = 16 \\ 5 \times 5 = 25 \\ 6 \times 6 = 36 \\ 7 \times 7 = 49 \\ 8 \times 8 = 64 \\ 9 \times 9 = 81 \end{array}$$



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

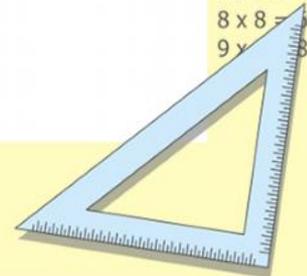
$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

$$\sin 90^\circ = 1$$



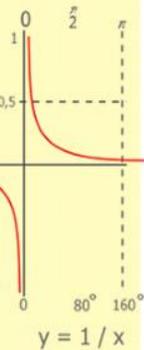
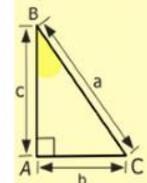
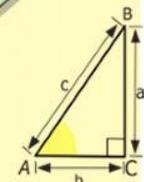
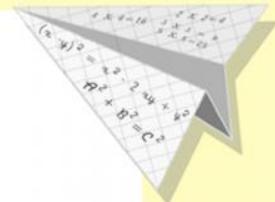
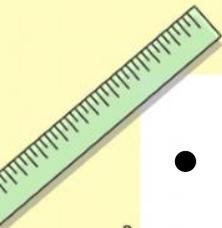
$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$
$$\begin{cases} y = 1 \\ x = 25 + 45 \\ \hline x = 70 \end{cases}$$

$$(x+y)(x-y) = x^2 - y^2$$



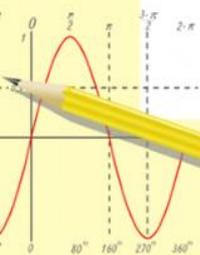
# Домашнее задание

- №684(2,4); №685(2) №683(1;2;)



$$\begin{array}{r} \frac{1}{2} 500 \\ \times 42 \\ \hline 210 \\ + 84 \\ \hline 105000 \end{array}$$

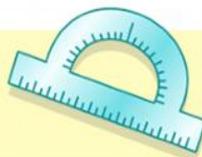
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