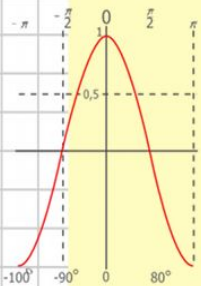
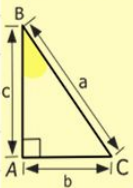
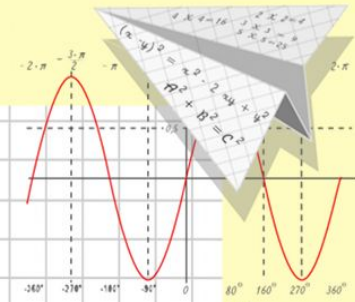
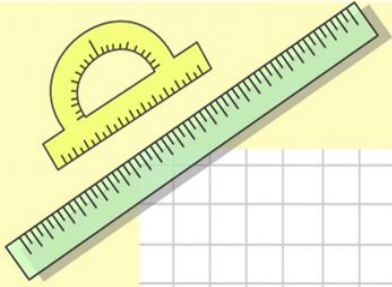


# Математик

а

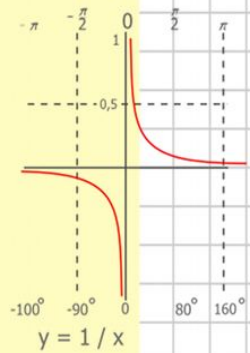
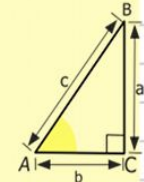
## Натуральные логарифмы

Расширить понятие логарифма, для этого введя понятие натурального логарифма, выяснить взаимное расположение графиков функции натурального логарифма и показательной, научиться использовать свойства для вычисления натуральных логарифмов



$$y = \cos x$$

- 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



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



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

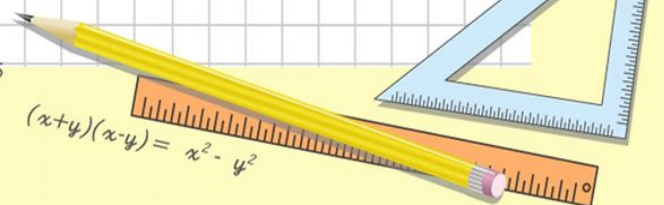
$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$



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



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

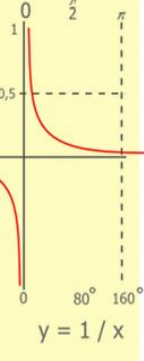
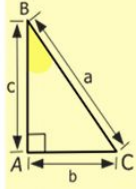
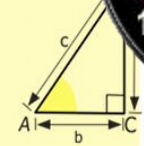
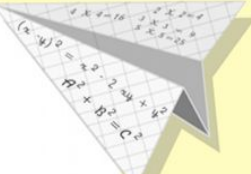
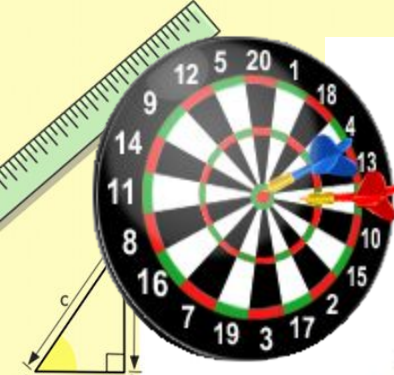


$$(x+y)(x-y) = x^2 - y^2$$

# «Логарифмический дартс»

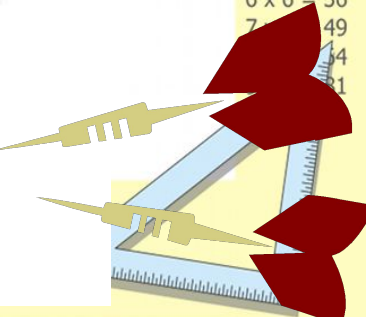
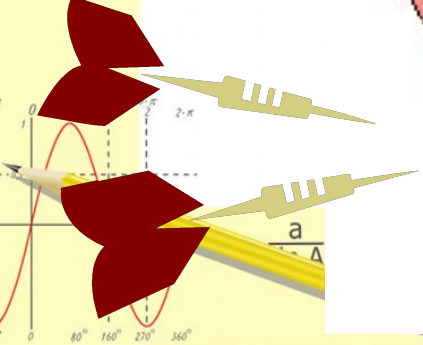
A circular dartboard divided into 21 segments of different colors, each containing a mathematical expression involving logarithms. The segments are arranged in three concentric rings. The expressions are:

- Outer Ring:**
  - $2^{-2\log_2 5}$
  - $\lg 8 + \lg 125$
  - $7^{\log_7 2} + 2$
  - $\lg 100$
  - $\log_{25} 125$
  - $\log_{\sqrt{5}} 1$
  - $\lg 13 - \lg 130$
  - $\lg \frac{1}{1000}$
  - $\log_2 32$
  - $\log_4 8$
  - $\log_5 125$
  - $\log_4 2$
  - $\log_3 27$
  - $\log_2 8$
  - $\log_{27} 9$
  - $\log_{\frac{1}{3}} \frac{1}{9}$
  - $\log_{100} 10$
  - $\log_{16} 8$
  - $\log_2 81$
  - $\log_3 9$
  - $\log_{\frac{1}{3}} \frac{1}{9}$
- Middle Ring:**
  - $\log \frac{1}{4}$
  - $\log_4 2$
  - $\log_3 27$
  - $\log_2 8$
  - $\log_3 9$
  - $\log_8 16$
  - $\log_3 81$
  - $\log_4 64$
  - $\log_2 16$
  - $\log_3 81$
  - $\log_2 8$
  - $\log_{\frac{1}{3}} \frac{1}{9}$
  - $\log_2 8$
  - $\log_3 9$
  - $\log_{\frac{1}{3}} \frac{1}{9}$
- Inner Ring:**
  - $\log_2 32$
  - $\log_4 2$
  - $\log_3 27$
  - $\log_2 8$
  - $\log_3 9$
  - $\log_8 16$
  - $\log_3 81$
  - $\log_4 64$
  - $\log_2 16$
  - $\log_3 81$
  - $\log_2 8$
  - $\log_{\frac{1}{3}} \frac{1}{9}$
  - $\log_{100} 10$
  - $\log_8 16$
  - $\log_3 9$
  - $\log_{\frac{1}{3}} \frac{1}{9}$

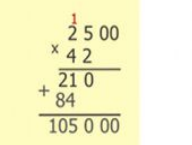
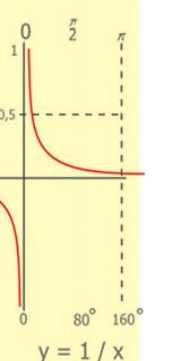
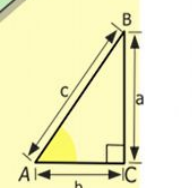
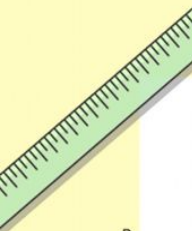


$$\begin{array}{r} 1 \ 2 \ 5 \ 0 \ 0 \\ \times 42 \\ \hline 21 \ 0 \\ + 84 \phantom{0} \\ \hline 105 \ 0 \ 0 \ 0 \end{array}$$

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



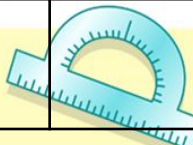
|    |  |                 |    |                            |                |
|----|--|-----------------|----|----------------------------|----------------|
| 1  | $\log_5 5^7$                                       | -2              | 11 | $\lg 1$                    | 7              |
| 2  | $\log_{11} x = 2$                                  | 4               | 12 | $\log_x 7 = 1$             | 2              |
| 3  | $\log_{\frac{1}{2}} 4$                             | 4               | 13 | $\log_2 16 = x$            | 4              |
| 4  | $\log_5 x = -3$                                    | 0,1             | 14 | $\log_7 7^4$               | 0              |
| 5  | $\lg 1000$   | 7               | 15 | $\log_{\frac{1}{5}} 3125$  | 4              |
| 6  | $\log_2 x = 2$                                     | 121             | 16 | $\log_x \frac{1}{343} = 3$ | 4              |
| 7  | $\lg x = -1$                                       | 3               | 17 | $\log_6 x = -2$            | -5             |
| 8  | $\log_x 4 = 1$                                     | -4              | 18 | $\log_7 49$                | $\frac{1}{36}$ |
| 9  | $\log_5 \frac{1}{625}$                             | 0,04            | 19 | $\log_x 256 = 4$           | -5             |
| 10 | $\log_{\frac{c}{a}} \frac{c}{b} x = \frac{2}{0.2}$ | $\frac{1}{125}$ |    |                            |                |



$$\log_{\frac{c}{a}} \frac{c}{b} x = \frac{2}{0.2}$$

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

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

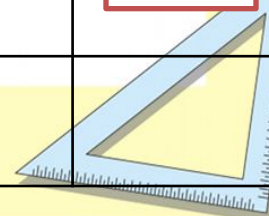


$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

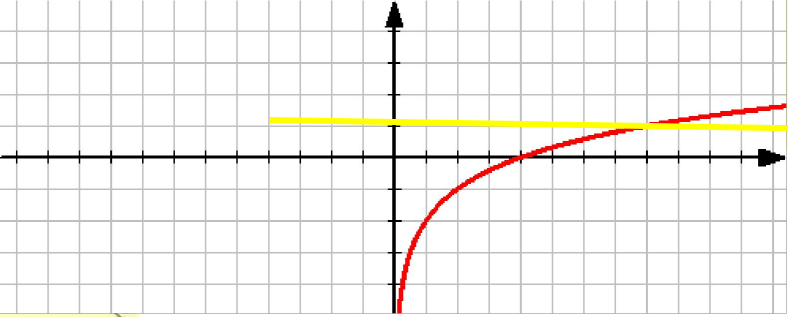
$$\begin{cases} y = 1 \\ x = 25 + 45 \end{cases}$$

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

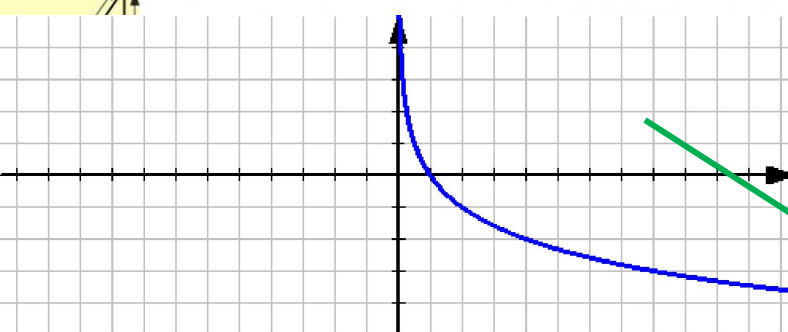
$$x = 70$$



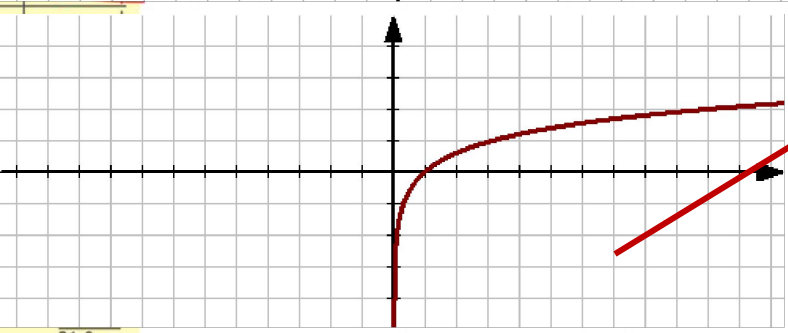
|            |
|------------|
| 2 x 2 = 4  |
| 3 x 3 = 9  |
| 4 x 4 = 16 |
| 5 x 5 = 25 |
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| 7 x 7 = 49 |
| 8 x 8 = 64 |
| 9 x 9 = 81 |



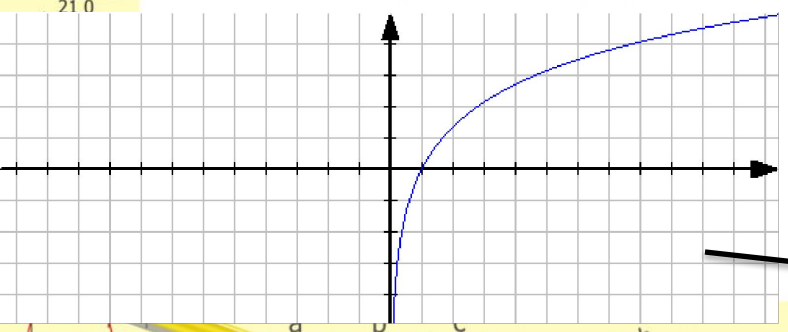
$$y = \log_2 x - 2$$



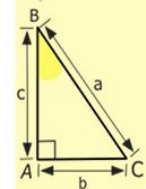
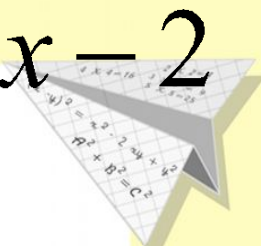
$$y = \lg x$$



$$y = \log_{\frac{1}{2}} x$$



$$y = -\log_{0,6} x$$



$y = \cos$

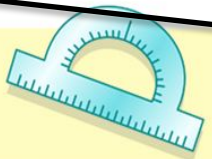
- $2 \times 2 = 4$
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$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

$\sin 90^\circ = 1$

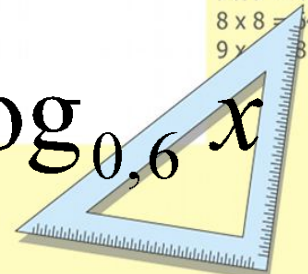


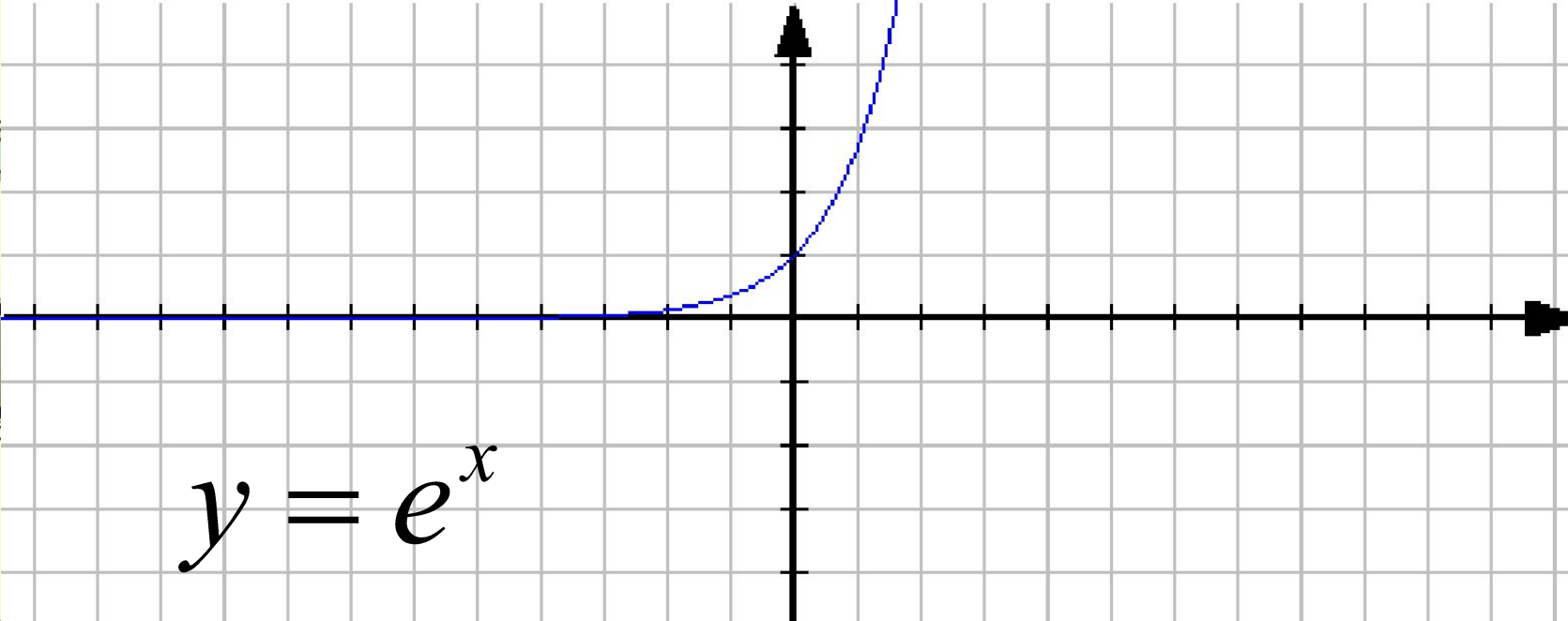
$$\begin{cases} y = \sin 90 \\ x = 25 + 45 \end{cases}$$

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

$$\frac{x}{70}$$

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




$$y = e^x$$

Не является ни четной, ни нечетной:

$$D(f) = (-\infty; +\infty)$$

Возрастает;

Не ограничена сверху, ограничена снизу

Не имеет наименьшего, наибольшего значений;

непрерывна

Выпукла вниз

$$E(f) = (-\infty; +\infty)$$

Дифференцируема

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

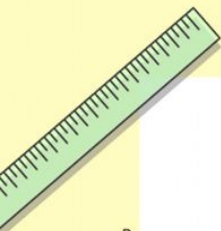
$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

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

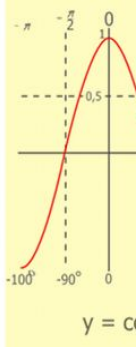
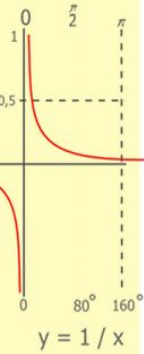
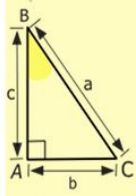
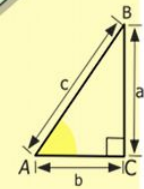
$$\begin{cases} y = 1 \\ x = 25 + 45 \\ x = 70 \end{cases}$$

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

- $2 \times 2 = 4$
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| Функция                          | Производная        |
|----------------------------------|--------------------|
| $y = 2e^x$                       | $y = 2e^x$         |
| $y = e^{2x}$                     | $y = 2e^{2x}$      |
| $y = e^x - x$                    | $y = e^x - 1$      |
| $y = e^{3x} - x^2$               | $y = 3e^{3x} - 2x$ |
| $y = \left(\frac{1}{e}\right)^x$ | $y = -e^x$         |



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

- 2 x 2 = 4
- 3 x 3 = 9
- 4 x 4 = 16
- 5 x 5 = 25
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$$\frac{a}{A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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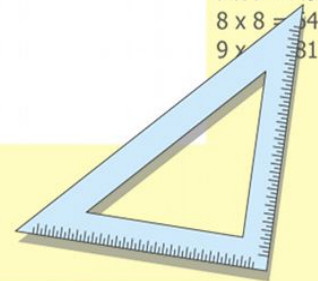
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$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

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

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



$$\int e^x dx = e^x + C$$

$$x^n$$

$$\frac{x^{n+1}}{n+1}$$

$$\cos x$$

$$-\sin x$$

$$\frac{1}{x^2}$$

$$\sin x$$

$$\cos x$$

$$\frac{1}{\sqrt{x}}$$

$$2\sqrt{x}; (x > 0)$$

$$y = f(kx+b)$$

$$y = \frac{1}{k} F(kx+b)$$

$$\frac{1}{\sin^2 x}$$

$$-\operatorname{ctg} x$$

$$y = f(x) + g(x)$$

$$Y = F(x) + G(x)$$

$$\frac{1}{\cos^2 x}$$

$$\operatorname{tg} x$$

$$y = kf(x)$$

$$Y = kF(x)$$

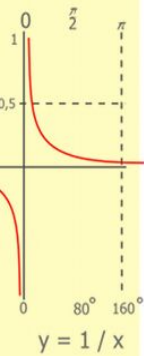
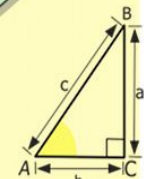
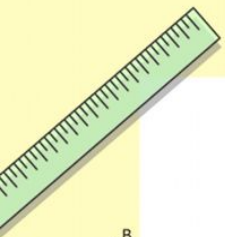
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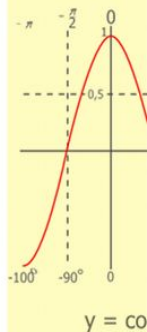
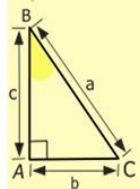
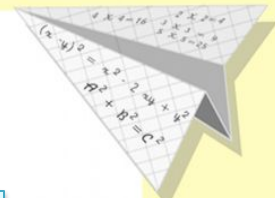
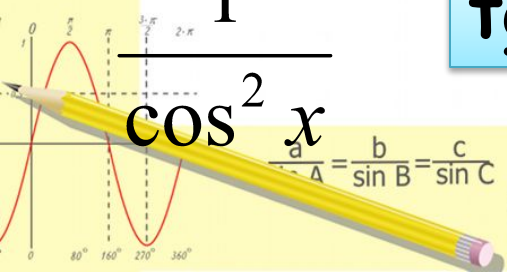
$$\sin 90^\circ = 1$$

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

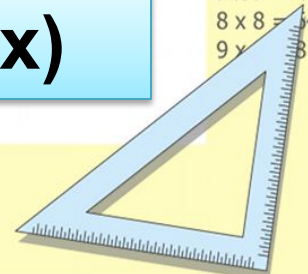
$$(x+y)(x-y) = x^2 - y^2$$

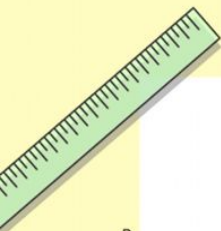


$$\begin{array}{r} 1\ 2\ 5\ 00 \\ \times 4\ 2 \\ \hline 21\ 0 \\ + 84 \\ \hline 105\ 0\ 00 \end{array}$$



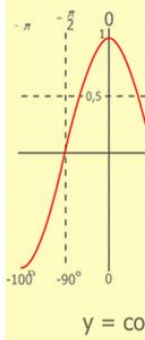
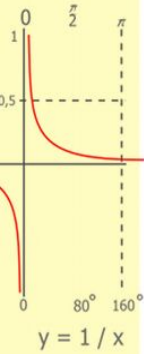
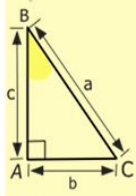
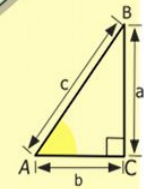
$$\begin{array}{l} 2 = 4 \\ 3 = 9 \\ 4 = 16 \\ 5 = 25 \\ 6 \times 6 = 36 \\ 7 \times 7 = 49 \\ 8 \times 8 = 64 \\ 9 \times 9 = 81 \end{array}$$





$$\int_b^a f(x) dx = F(b) - F(a).$$

$$\int_b^a f(x) dx = F(x) \Big|_a^b$$



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

- $2 \times 2 = 4$
- $3 \times 3 = 9$
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$$\frac{a}{A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

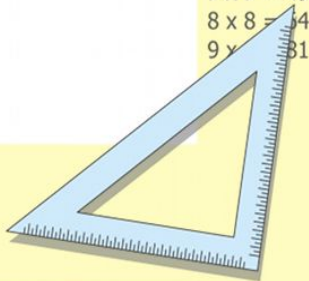
$\sin 90^\circ = 1$



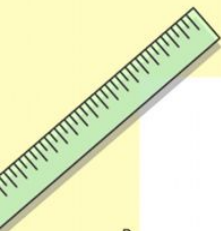
$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

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

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






$$\int 3e^x dx$$

$$3e^x + C$$

$$\int e^{2x-3} dx$$

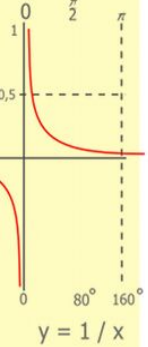
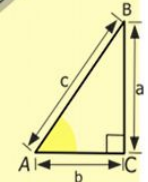
$$\frac{1}{2} e^{2x-3} + C$$

$$\int \frac{dx}{x^2}$$

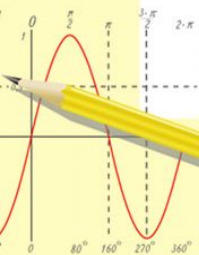
$$-\frac{1}{x} + C$$

$$\int (e^x + \sin 2x) dx$$

$$e^x - \frac{1}{2} \cos 2x + C$$



$$\begin{array}{r} 2500 \\ \times 42 \\ \hline 2100 \\ + 8400 \\ \hline 105000 \end{array}$$



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

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

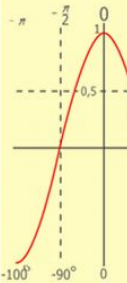
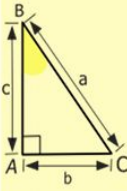
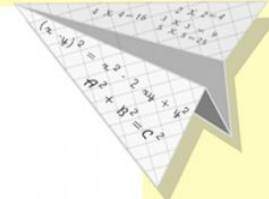
$$\sin 90^\circ = 1$$



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

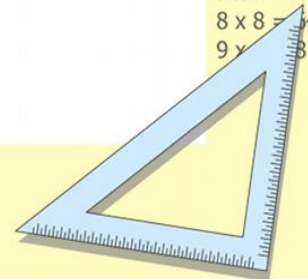
$$\begin{cases} y = 1 \\ x = 25 + 45 \\ \hline x = 70 \end{cases}$$

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



$$y = \cos$$

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

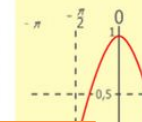
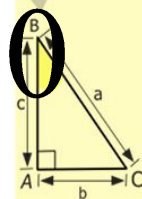
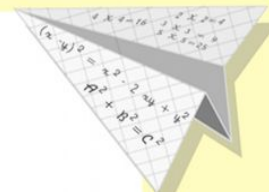


Десятичные логарифмы для наших потребностей являются весьма удобными. Однако при изучении высшей математики более удобными оказываются логарифмы по основанию  $e = 2,718281828\dots$  (см. § 134, ч. 1). Употребление этих логарифмов позволяет значительно упростить большое количество математических формул. Логарифмы по основанию  $e$  получаются при решении многих физических задач и естественным образом входят в математическое описание некоторых химических, биологических и других процессов. Этим и объясняется их название «натуральные логарифмы».

Натуральный логарифм числа  $a$  обозначается  $\ln a$ . Сейчас имеются достаточно полные таблицы

$$\log_e b = \ln b, b > 0$$

**Логарифм по основанию  $e$  называется натуральным логарифмом**



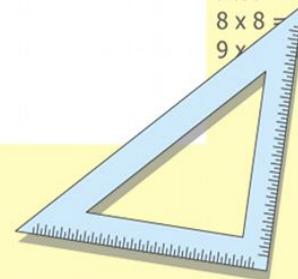
|         |    |
|---------|----|
| 3 x 3 = | 9  |
| 4 x 4 = | 16 |
| 5 x 5 = | 25 |
| 6 x 6 = | 36 |
| 7 x 7 = | 49 |
| 8 x 8 = | 64 |
| 9 x 9 = | 81 |



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

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

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



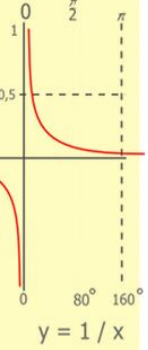
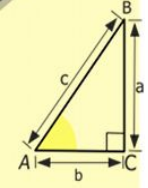
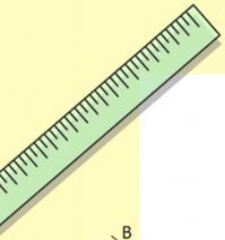
$$\ln 1 = 0$$

$$\ln e = 1$$

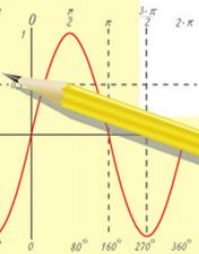
$$\ln e^r = r$$

$$e^{\ln x} = x$$

$$\log_a x = \frac{\ln x}{\ln a}$$



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



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

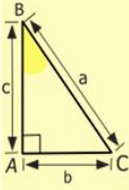
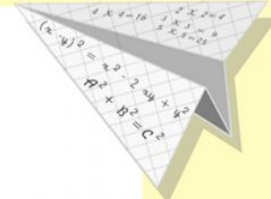
$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

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

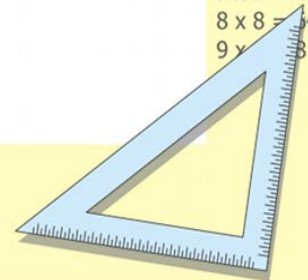


$$\begin{cases} y = \sin 90 \\ x = 25 + 45 \\ y = 1 \\ x = 25 + 45 \\ \hline x = 70 \end{cases}$$

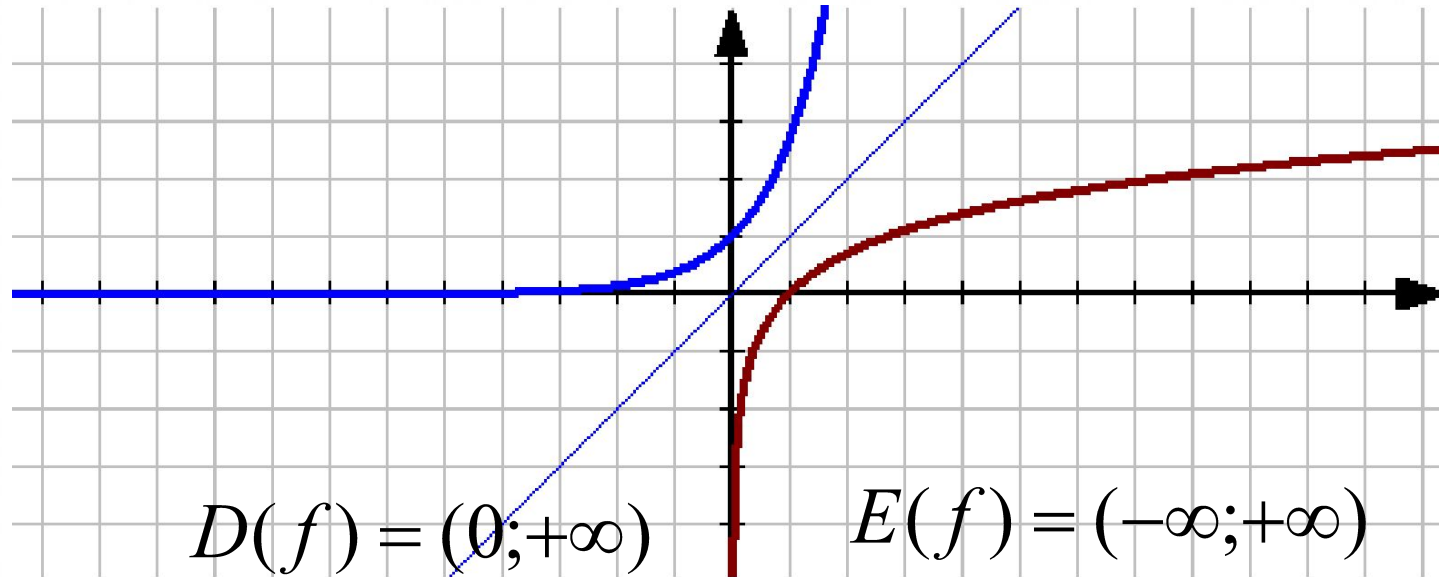
$$(x+y)(x-y) = x^2 - y^2$$



- 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



# Функция вида $y = \ln x$ , свойства и график



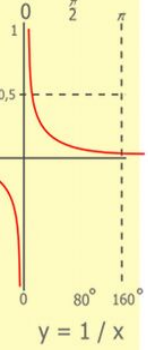
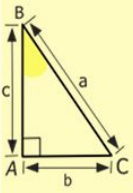
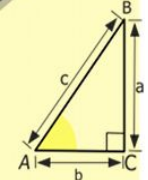
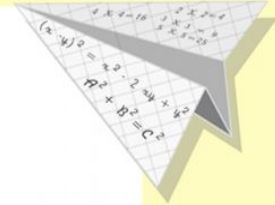
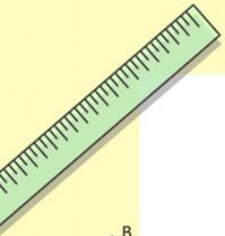
Ни четна, ни нечетна  
Не ограничена ни сверху, ни снизу  
Не имеет наибольшего, наименьшего значений  
Непрерывна  
Выпукла вверх  
дифференцируема

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

$$(\ln x)' = \frac{1}{x}$$

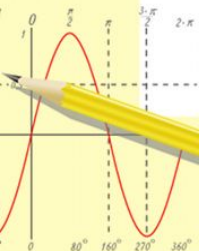
$$\int \frac{dx}{x} = \ln|x| + C$$

$$(\log_a x)' = \frac{1}{x \ln a}$$



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

- 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



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

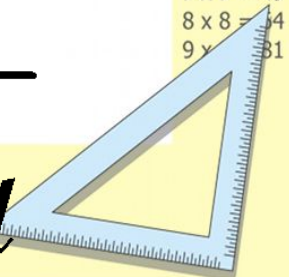
$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

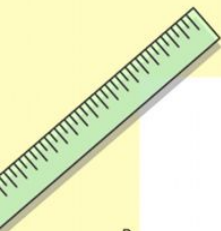
$$\sin 90^\circ = 1$$



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

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




$$y = \ln(3x + 5), x = -1$$

$$y' = (\ln(3x + 5))' = 3 \cdot \frac{1}{3x + 5} = \frac{3}{3x + 5}$$

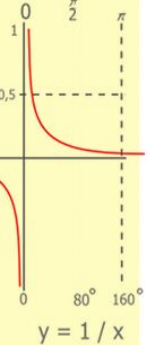
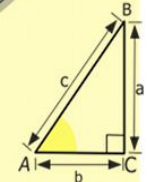
$$y'(-1) = \frac{3}{3(-1) + 5} = 1,5$$

$$y = \log_2 x$$

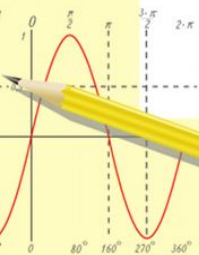
$$y' = \frac{1}{x \ln 2}$$

1633, 1634, 1635, 1636(а,б)

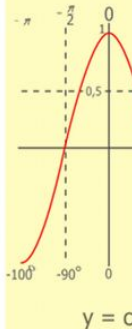
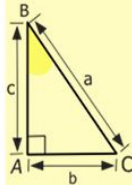
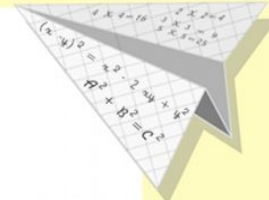
Дома: в,г



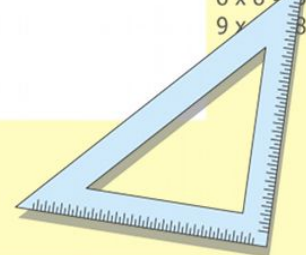
$$\begin{array}{r} 2500 \\ \times 42 \\ \hline 210 \\ + 84 \\ \hline 105000 \end{array}$$



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



- 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



№1633

$$y = x^2 \ln x$$

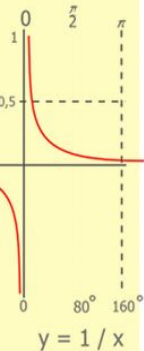
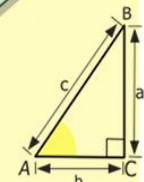
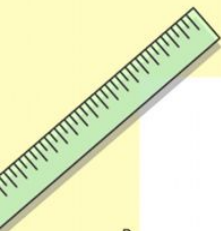
$$y' = (x^2)' \ln x + x^2 (\ln x)'$$

$$y' = 2x \ln x + x^2 \cdot \frac{1}{x} = 2x \ln x + x$$

$$y = \frac{\ln x}{x+1}$$

$$y'' = \frac{(\ln x)'(x+1) - \ln x(x+1)'}{(x+1)^2} =$$

$$\frac{\frac{1}{x} \cdot (x+1) - \ln x}{(x+1)^2} = \frac{x+1 - x \ln x}{x(x+1)^2}$$



$\frac{1}{2} 500$   
 $\times 42$   
 $\hline 210$   
 $+ 84$   
 $\hline 10500$



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

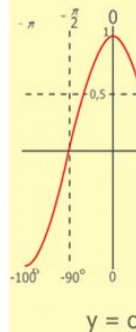
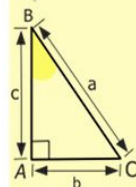
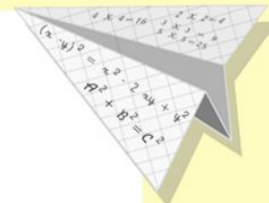
$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

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

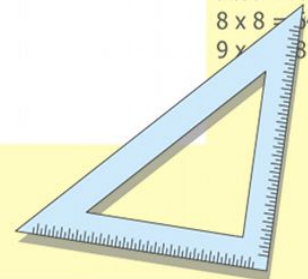


$$\begin{cases} x = \sin 90^\circ \\ x = 2y + 45 \\ y = 1 \\ x = 25 + 45 \\ x = 70 \end{cases}$$

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



- 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



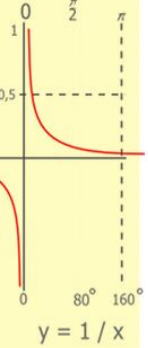
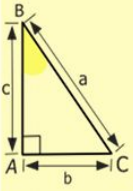
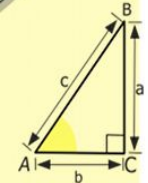
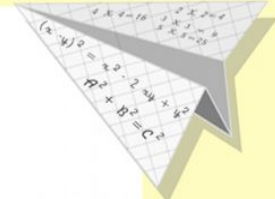
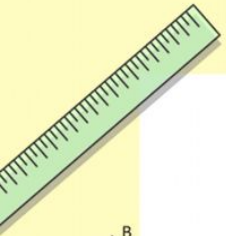
№1634

$$y = e^x \ln x$$

$$y' = e^x \ln x + \frac{e^x}{x}$$

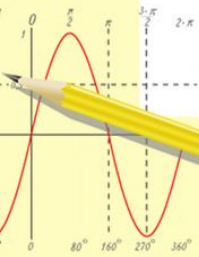
$$y = 3 \ln x + \sin 2x$$

$$y' = \frac{3}{x} + 2 \cos 2x$$



$\frac{1}{2} 5 00$   
 $\times 4 2$   
 $\hline 21 0$   
 $+ 84$   
 $\hline 105 0 00$

- 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



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

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

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

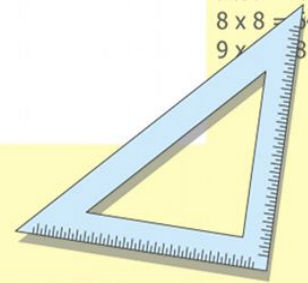


$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

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

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

$$\frac{x}{70}$$





№1635

$$y = \ln x + x, x_0 = \frac{1}{7}$$

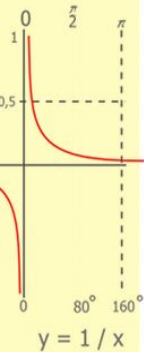
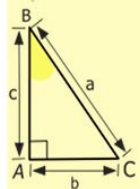
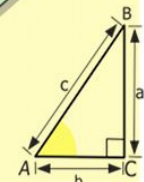
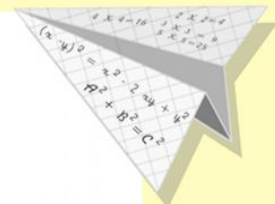
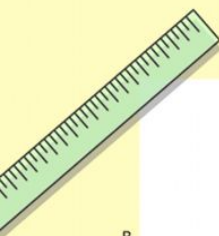
$$y' = \frac{1}{x} + 1$$

$$y' = 8$$

$$y = x^3 \ln x, x_0 = e$$

$$y' = 3x^2 \ln x + x^2$$

$$y' = 3e^2 + e^2 = 4e^2$$



1/2500  
x 42  
-----  
210  
+ 84  
-----  
10500

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



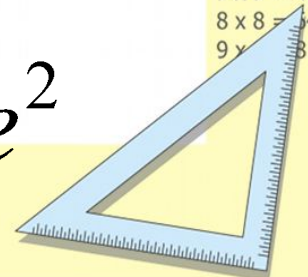
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$
$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

$\sin 90^\circ = 1$



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

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



№1636

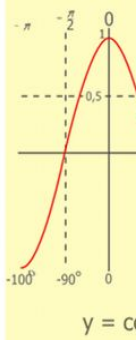
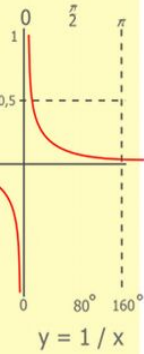
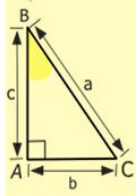
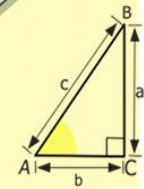
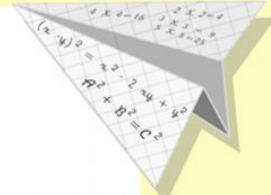
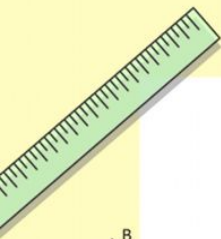
$$y = \ln(2x + 2), x_0 = -\frac{1}{4}$$

$$y' = \frac{2}{2x + 2} = \frac{1}{x + 1}$$

$$y' = \frac{1}{1 - \frac{1}{4}} = \frac{4}{3} = 1\frac{1}{3}$$

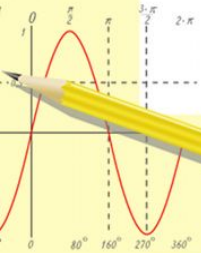
$$y = \ln(5 - 2x), x_0 = 2$$

$$y' = -\frac{2}{5 - 2x} = -\frac{2}{1} = -2$$



2 5 00  
x 4 2  
+ 21 0  
+ 84  
-----  
105 0 00

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



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

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

sin 90° = 1

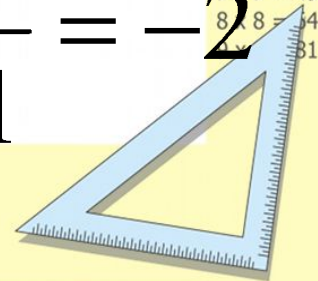


$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

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

$$x = 70$$

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



Составить уравнение касательной к графику функции  $y = \ln x$  в точке  $x = e$

$$y = f'(x_0)(x - x_0) + f(x_0)$$

$$f(x_0) = \ln e = 1$$

$$f'(x) = \frac{1}{x}$$

$$f'(x_0) = \frac{1}{e}$$

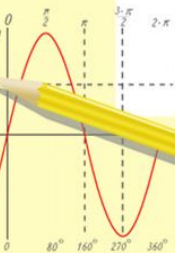
$$y = \frac{1}{e}(x - e) + 1 = \frac{x}{e} - 1 + 1 = \frac{x}{e}$$

№1623,1637,1

641 (а,б)

В,Г - ДОМА

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



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

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

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

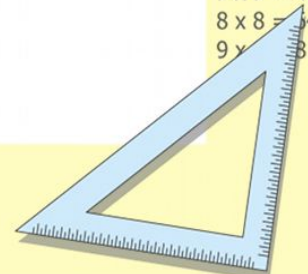


$$\begin{cases} y = \sin 90 \\ x = 25 + 45 \end{cases}$$

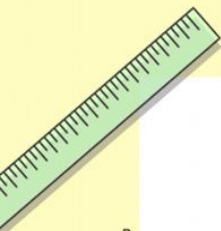
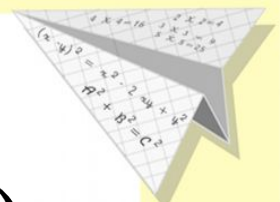
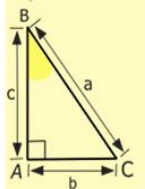
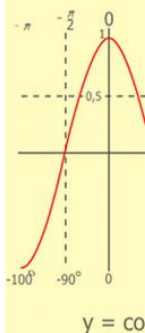
$$\begin{cases} y = 1 \\ x = 25 + 45 \end{cases}$$

$$x = 70$$

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

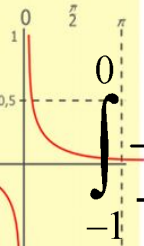
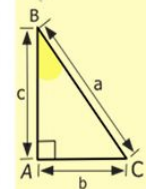
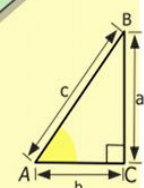


- 2 x 2 = 4
- 3 x 3 = 9
- 4 x 4 = 16
- 5 x 5 = 25
- 6 x 6 = 36
- 7 x 7 = 49
- 8 x 8 = 64
- 9 x 9 = 81



$$\int_1^2 \frac{dx}{x} = \ln|x| \Big|_1^2 = \ln 2 - \ln 1 = \ln 2$$

$$\int_1^2 \left( e^x + \frac{1}{x} \right) dx = \left( e^x + \ln|x| \right) \Big|_1^2 = e^2 - e + \ln 2 - \ln 1 = e^2 - e + \ln 2$$



$$\int_{-1}^0 \frac{dx}{-5x+6} = -\frac{1}{5} \ln|-5x+6| \Big|_{-1}^0 =$$

$$-\frac{1}{5} (\ln 6 - \ln 11) = -\frac{1}{5} \ln \frac{6}{11}$$

$y = 1/x$

|   |          |
|---|----------|
| 1 | 2 5 00   |
| x | 4 2      |
|   | 21 0     |
| + | 84       |
|   | 105 0 00 |

- 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

$$\int_3^6 \frac{dx}{2x-3} = \frac{1}{2} \ln(|2x-3|) \Big|_3^6 = \frac{1}{2} (\ln 9 - \ln 3)$$

$$\frac{1}{2} \ln \frac{9}{3} = \frac{1}{2} \ln 3$$

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

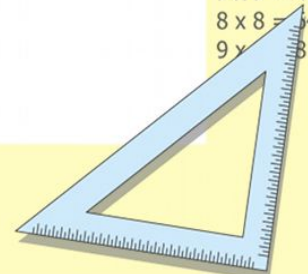
$$\begin{cases} y = 1 \\ x = 25 + 45 \end{cases}$$

$$\frac{x}{70}$$

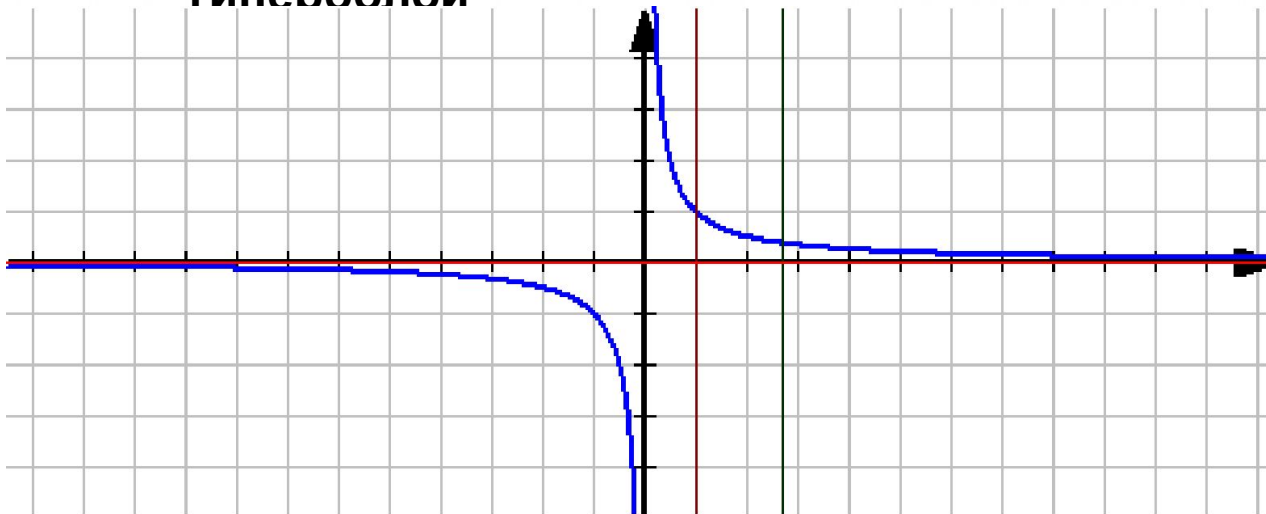
$$(x+y)(x-y) = x^2 - y^2$$

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

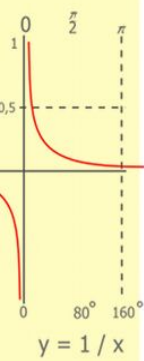
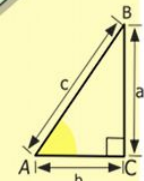
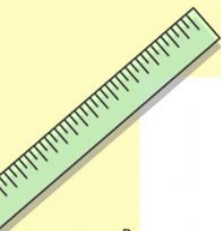
$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$



Вычислить площадь фигуры,  
ограниченной прямыми  $y=0$ ,  $x=1$ ,  $x=e$  и  
гиперболой  $y = \frac{1}{x}$



$$S = \int_1^e \frac{dx}{x} = \ln x \Big|_1^e = \ln e - \ln 1 = 1$$



$\frac{1}{2} 5 00$   
 $\times 42$   
 $\hline 21 0$   
 $+ 84$   
 $\hline 105 0 00$



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

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

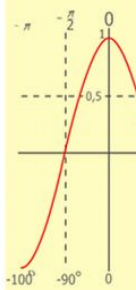
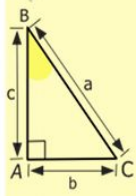
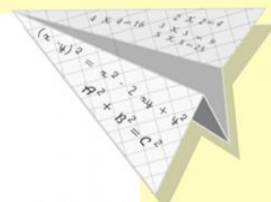
$$\sin 90^\circ = 1$$



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

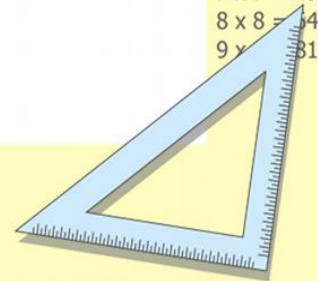
$$\begin{cases} y = 1 \\ x = 25 + 45 \\ \hline x = 70 \end{cases}$$

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



$$y = \cos$$

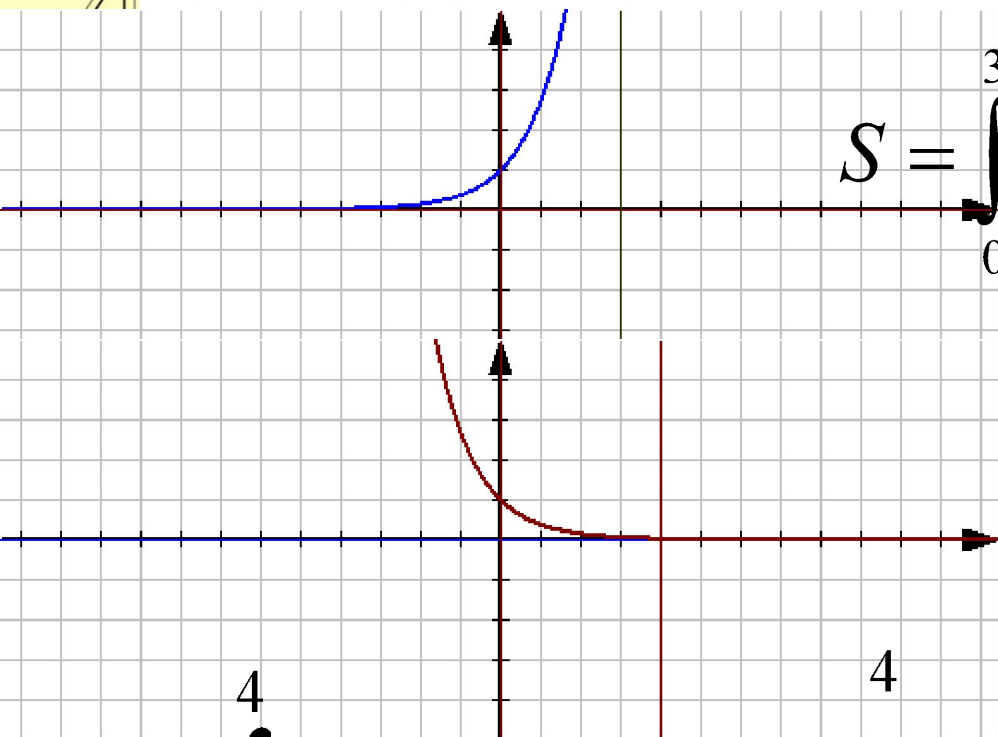
- 2 x 2 = 4
- 3 x 3 = 9
- 4 x 4 = 16
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- 7 x 7 = 49
- 8 x 8 = 64
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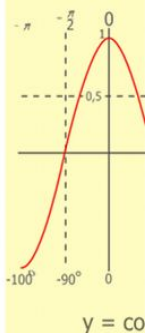
№1628, 1629, 1642, 1645 (а,б) дома: в,г

$$y = 0, x = 0, x = 3, y = e^x$$

$$S = \int_0^3 e^x dx = e^x \Big|_0^3 = e^3 - 1$$



$$S = \int_0^4 e^{-x} dx = -e^{-x} \Big|_0^4 = -e^{-4} - (-e^0) = 1 - \frac{1}{e^4}$$



- 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



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

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

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

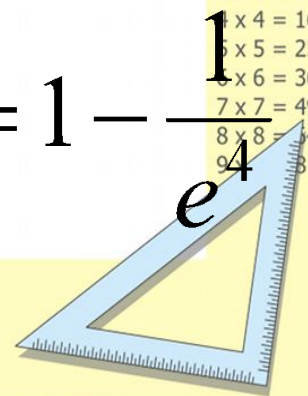


$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

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

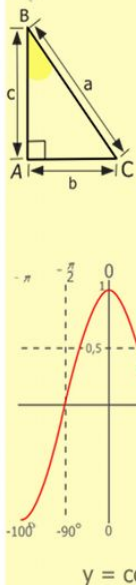
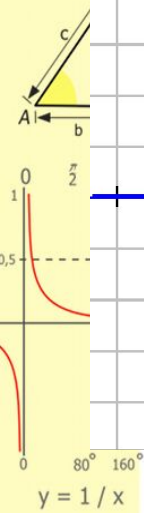
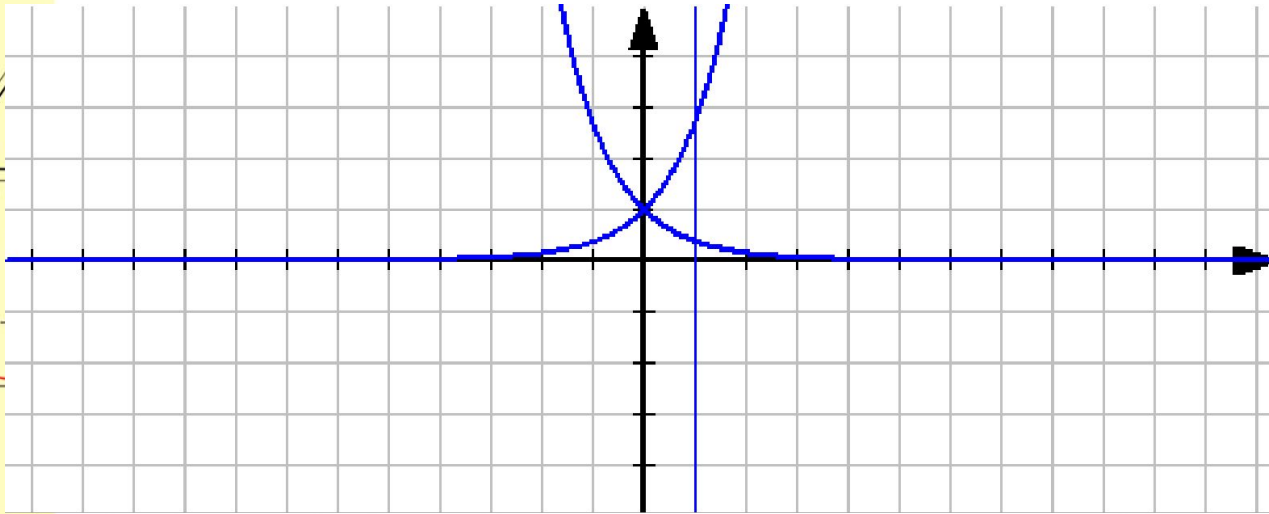
$$x = 70$$

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



№1629 (a)

$$x = 1, y = e^x, y = e^{-x}$$



$$S = \int_0^1 e^x dx - \int_0^1 e^{-x} dx = e^x \Big|_0^1 - (-e^{-x}) \Big|_0^1 =$$

$$e - 1 + e^{-1} - 1 = e - 2 + \frac{1}{e} = \frac{e^2 - 2e + 1}{e} = \frac{(e-1)^2}{e}$$

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

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

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

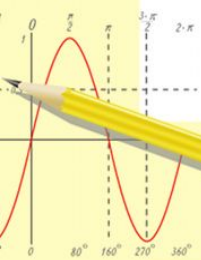
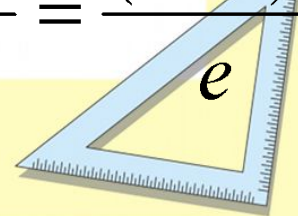
$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

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



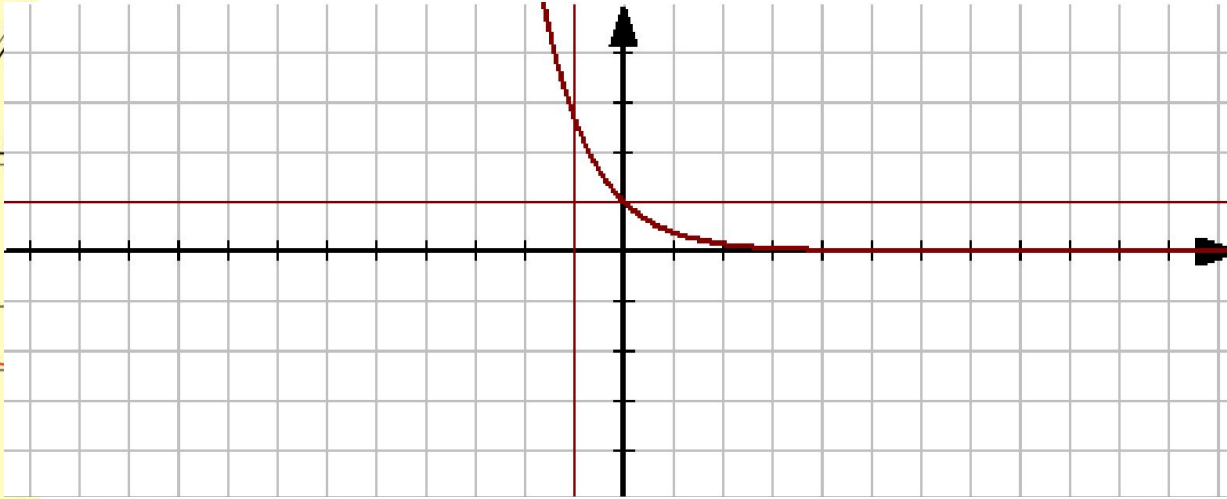
$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \\ y = 1 \\ x = 25 + 45 \\ x = 70 \end{cases}$$

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

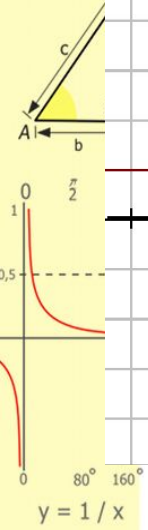


№1629(б)

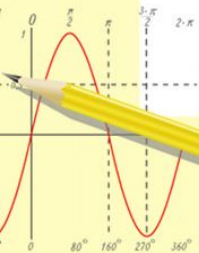
$$y = \frac{1}{e^x}, y = 1, x = -1$$



$$S = \int_{-1}^0 e^{-x} dx - S_{KB} = -e^{-x} \Big|_{-1}^0 - 1 = -1 + e - 1 = e - 2$$



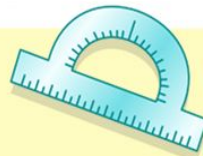
$$\begin{array}{r} 1\ 5\ 00 \\ \times 42 \\ \hline 21\ 0 \\ + 84 \\ \hline 105\ 0\ 00 \end{array}$$



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

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

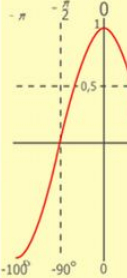
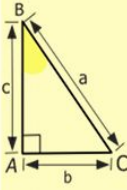
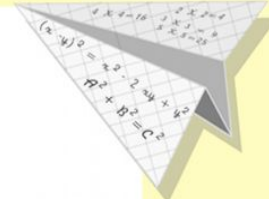
$$\sin 90^\circ = 1$$



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

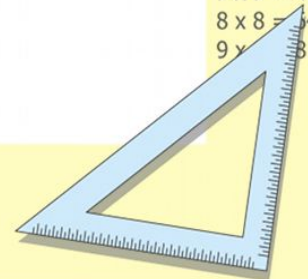
$$\begin{cases} y = 1 \\ x = 25 + 45 \\ \hline x = 70 \end{cases}$$

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



y = cos

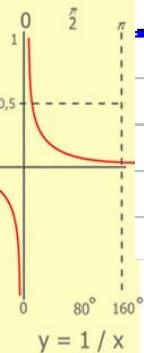
- 2 x 2 = 4
- 3 x 3 = 9
- 4 x 4 = 16
- 5 x 5 = 25
- 6 x 6 = 36
- 7 x 7 = 49
- 8 x 8 = 64
- 9 x 9 = 81





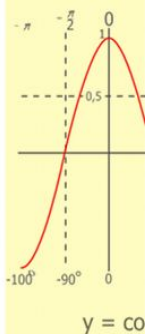
№1642

$$y = 0, x = 1, x = e, y = \frac{1}{x}$$



$$\begin{array}{r} 1\ 5\ 00 \\ \times 42 \\ \hline 210 \\ + 84 \\ \hline 105\ 000 \end{array}$$

$$S = \int_1^e \frac{dx}{x} = \ln x \Big|_1^e = \ln e - \ln 1 = 1$$



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



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

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

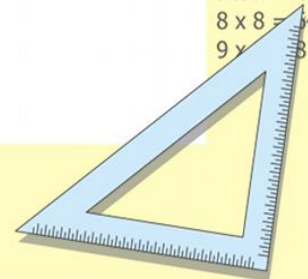
$$\sin 90^\circ = 1$$



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

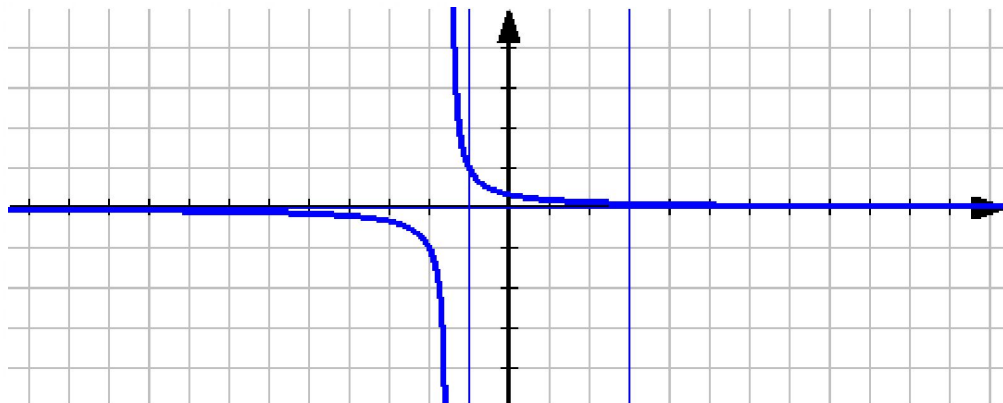
$$\begin{cases} y = 1 \\ x = 25 + 45 \\ \hline x = 70 \end{cases}$$

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



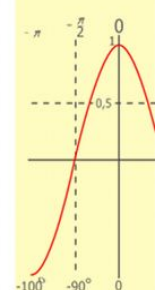
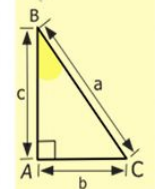
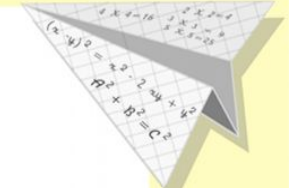
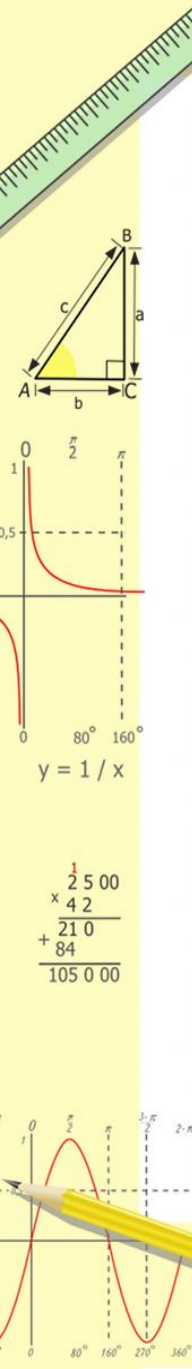
№1642(б)

$$y = 0, x = 3, x = -1, y = \frac{1}{2x+3}$$



$$S = \int_{-1}^3 \frac{dx}{2x+3} = \frac{1}{2} \ln(2x+3) \Big|_{-1}^3 = \frac{1}{2} (\ln 9 - \ln 1) =$$

$$\frac{1}{2} \ln 9 = \frac{1}{2} \ln 3^2 = \frac{1}{2} \cdot 2 \ln 3 = \ln 3$$



y = cos

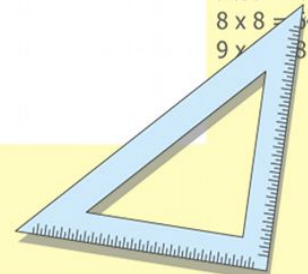
|            |
|------------|
| 2 x 2 = 4  |
| 3 x 3 = 9  |
| 4 x 4 = 16 |
| 5 x 5 = 25 |
| 6 x 6 = 36 |
| 7 x 7 = 49 |
| 8 x 8 = 64 |
| 9 x 9 = 81 |

sin 90° = 1



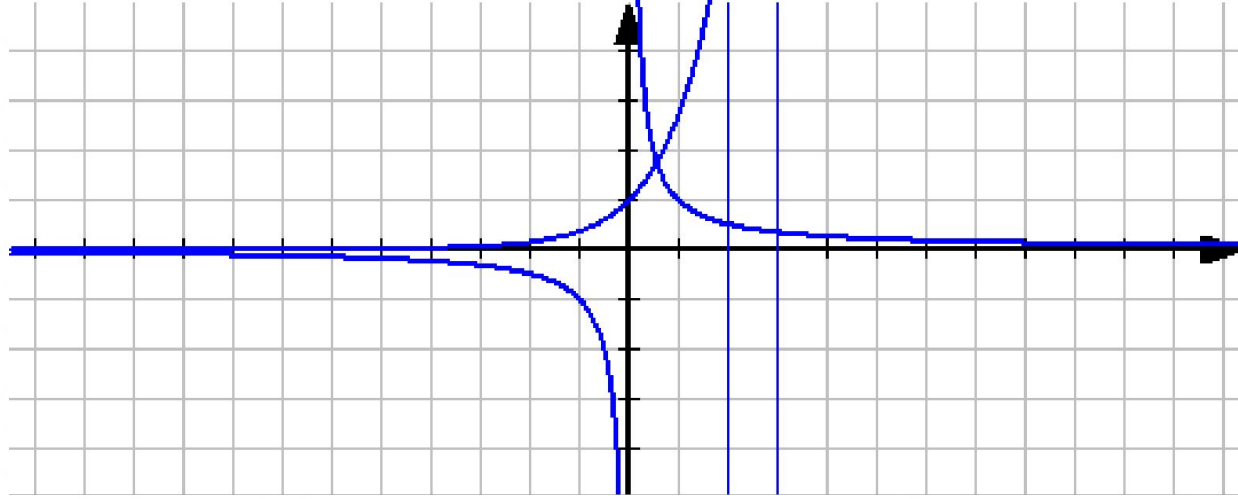
$$\begin{cases} x = 25y + 45 \\ y = 1 \\ x = 25 + 45 \\ x = 70 \end{cases}$$

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



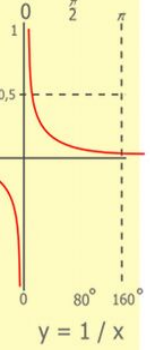
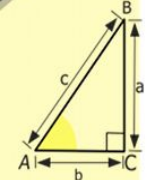
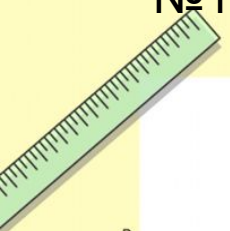
№1645 (a)

$$y = e^x, y = \frac{1}{x}, x = 2, x = 3$$



$$S = \int_2^3 e^x dx - \int_2^3 \frac{dx}{x} = e^x \Big|_2^3 - \ln x \Big|_2^3 =$$

$$e^3 - e^2 - \ln 3 + \ln 2 = e^3 - e^2 + \ln \frac{2}{3}$$



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



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

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

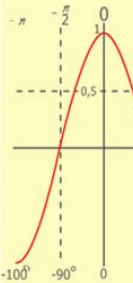
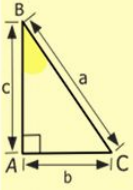
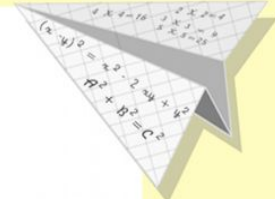
$$\sin 90^\circ = 1$$



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

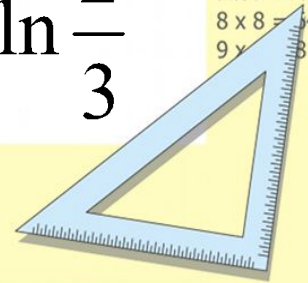
$$\begin{cases} y = 1 \\ x = 25 + 45 \\ \hline x = 70 \end{cases}$$

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



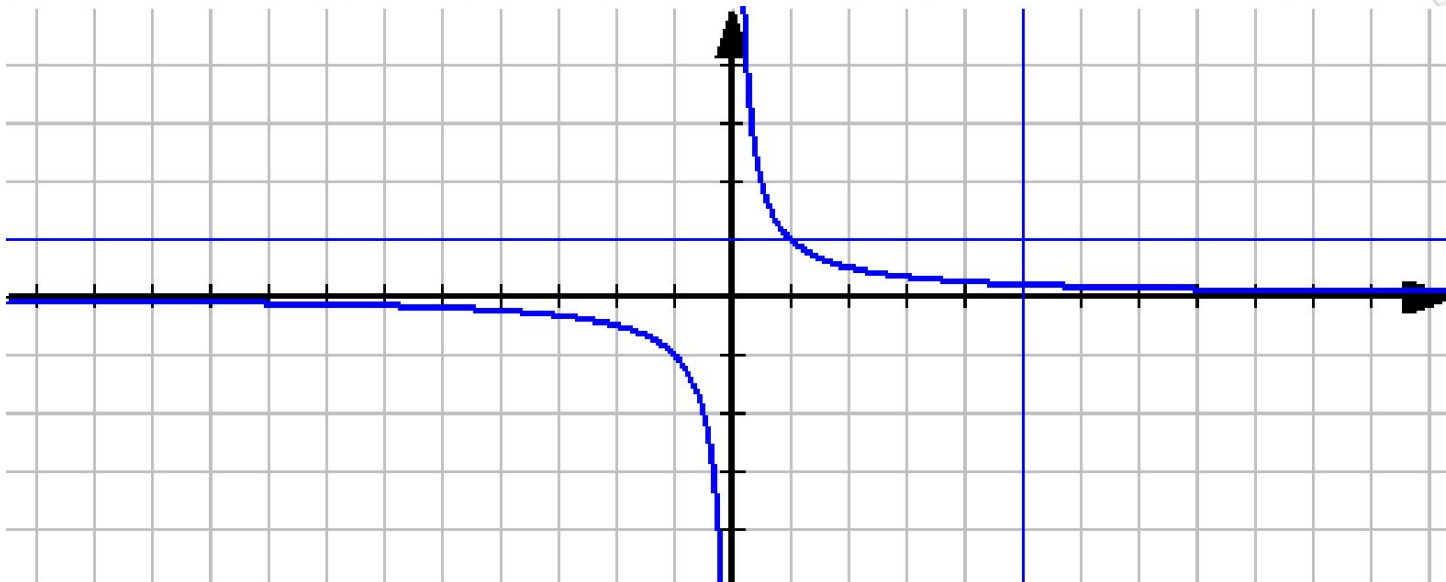
y = cos

- 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



№1645(б)

$$y = \frac{1}{x}, y = 1, x = 5$$



$$S = 1 \cdot 5 - \int_1^5 \frac{dx}{x} = 5 - \ln 5$$

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

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

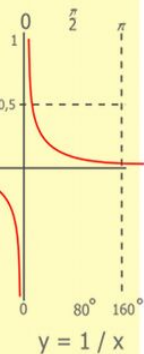
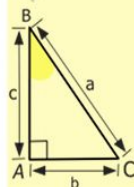
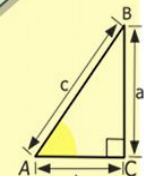
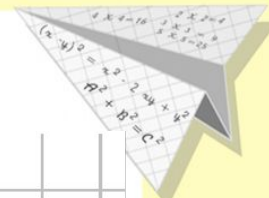
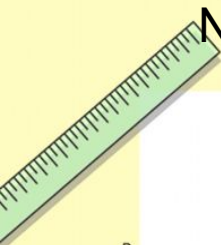
$$\sin 90^\circ = 1$$

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

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

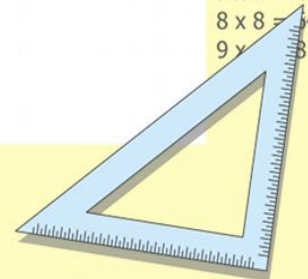
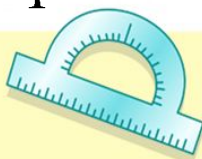
$$x = 70$$

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



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

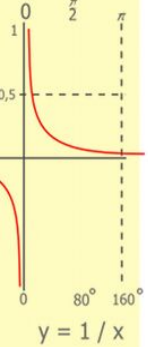
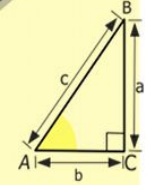
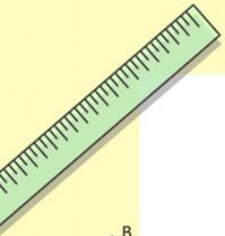
- 2 x 2 = 4
- 3 x 3 = 9
- 4 x 4 = 16
- 5 x 5 = 25
- 6 x 6 = 36
- 7 x 7 = 49
- 8 x 8 = 64
- 9 x 9 = 81



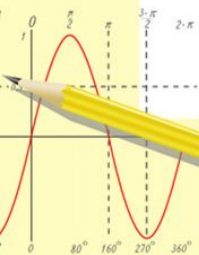
## Задание на каникулы:

Создать справочник по формулам (лучше напечатать, чтобы можно было размножить), презентация, видеоролик и т.п.

1. Тригонометрические формулы
2. Тригонометрические уравнения (общий вид, частные случаи, методы решения)
3. Производная
4. Применение производной к исследованию функций
5. Функции, свойства, графики, преобразования
6. Первообразная и интеграл
7. Показательные уравнения и неравенства
8. Логарифмические уравнения и неравенства
9. Степени и корни
10. Системы уравнений
11. Основные типы задач



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



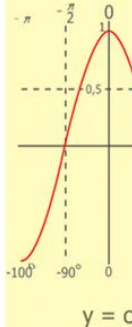
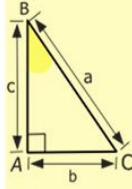
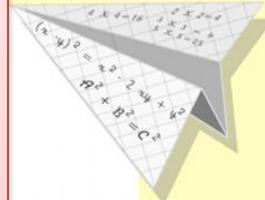
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

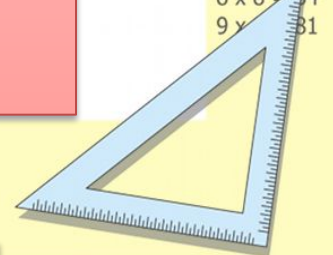
$$25y + 45$$

$$y = 1$$

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



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



12. РЕШАТЬ ВАРИАНТЫ