

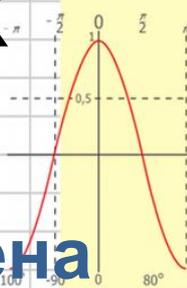
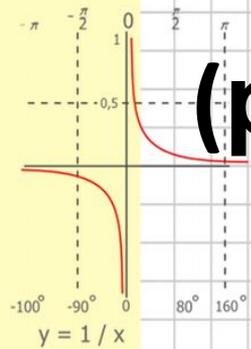
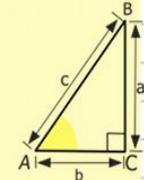
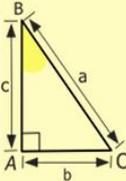
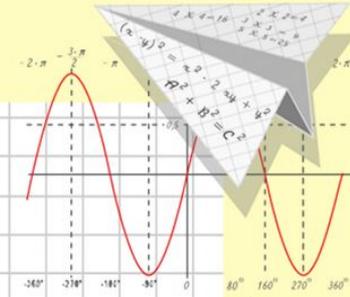
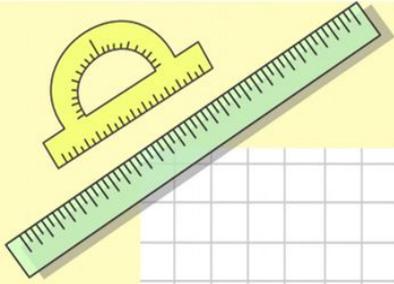
Математик

а

Подготовка к ЕГЭ

(решение стереометрических задач)

Выполнила: Чурина Елена
Вениаминовна, учитель первой
квалификационной категории
МБОУ СОШ №1 г. Южи Ивановской
области



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

$$\begin{array}{l} = \cos x \\ 1 \times 2 = 4 \\ 3 \times 3 = 9 \\ 4 \times 4 = 16 \\ 5 \times 5 = 25 \\ 6 \times 6 = 36 \\ 7 \times 7 = 49 \\ 8 \times 8 = 64 \end{array}$$

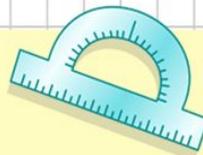


$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

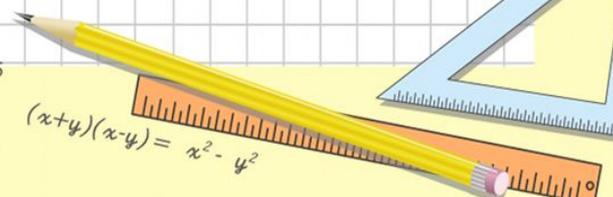
$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$



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



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

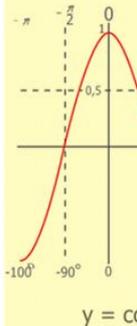
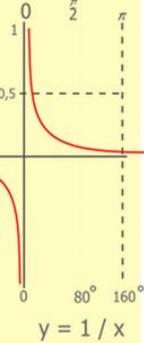
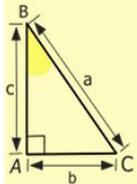
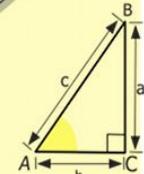
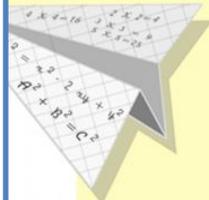
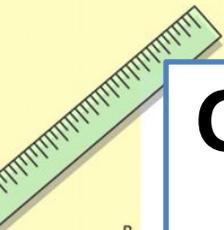
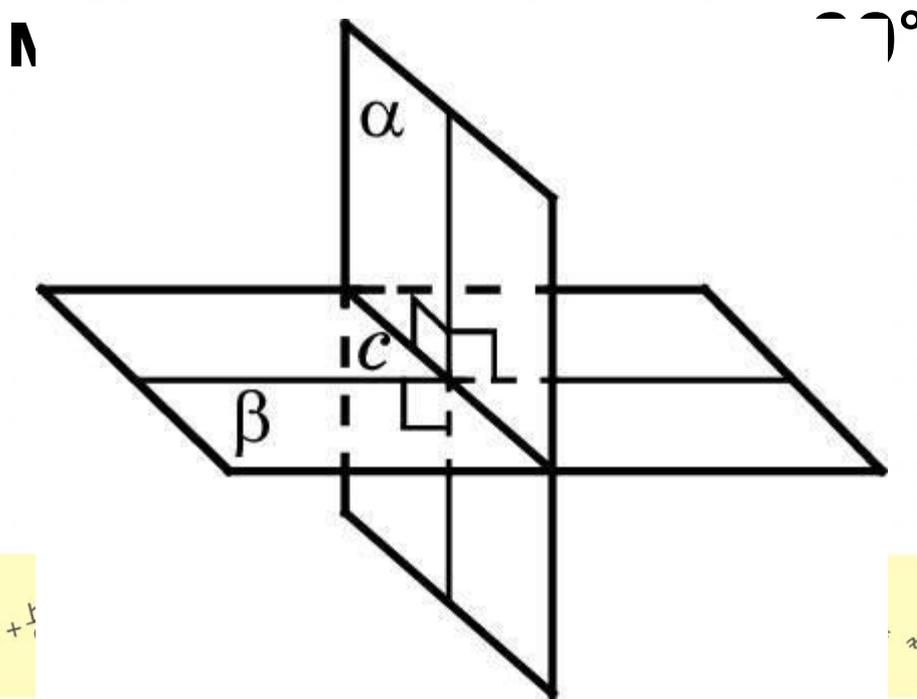


$$(x+y)(x-y) = x^2 - y^2$$

Повторение

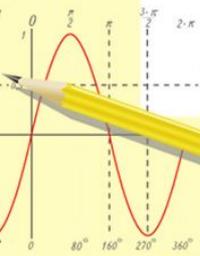
Определение перпендикулярности плоскостей

Две плоскости называются перпендикулярными (взаимно перпендикулярными), если угол



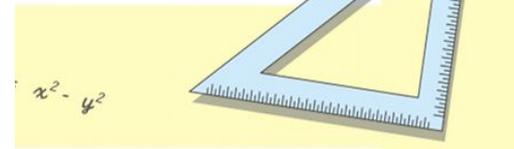
$$\begin{array}{r} 2500 \\ \times 42 \\ \hline 210 \\ + 84 \\ \hline 105000 \end{array}$$

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



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

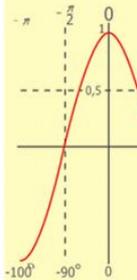
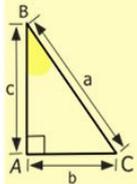
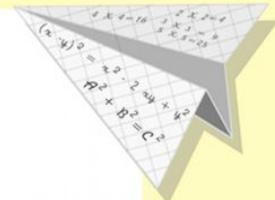
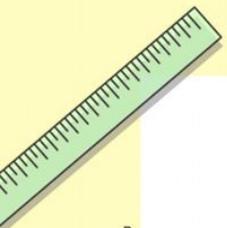
$$\frac{a}{c} + \dots$$



$$x^2 - 4^2$$

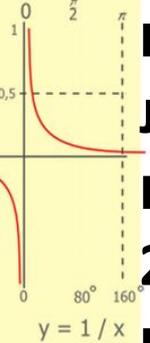
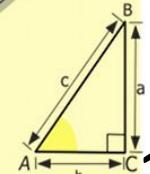
Свойства перпендикулярных плоскостей

1. Если прямая лежит в одной из двух взаимно перпендикулярных плоскостей и перпендикулярна линии их пересечения, то эта прямая перпендикулярна другой плоскости.
2. Если две плоскости, перпендикулярные третьей плоскости, пересекаются, то прямая их пересечения перпендикулярна третьей плоскости.
3. Если прямая, проведённая через точку одной из двух взаимно перпендикулярных плоскостей, перпендикулярна другой плоскости, то она лежит в первой из них.

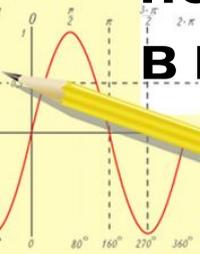


$y = \cos$

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



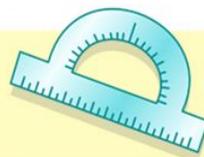
$$\begin{array}{r} 1 \\ \times 2500 \\ 210 \\ + 84 \\ \hline 105000 \end{array}$$



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

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

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

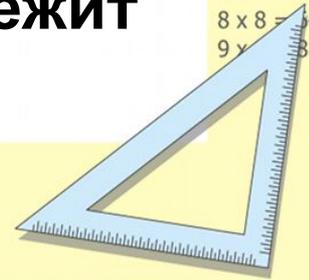


$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

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

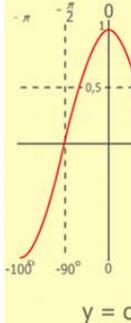
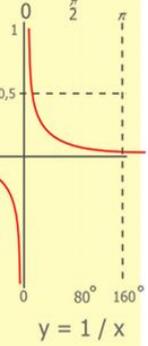
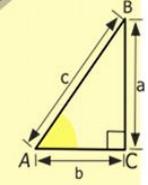
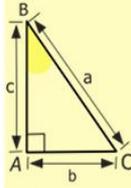
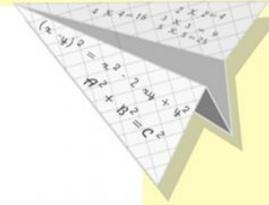
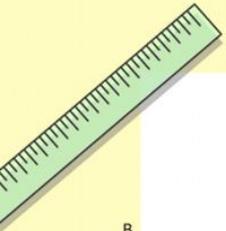
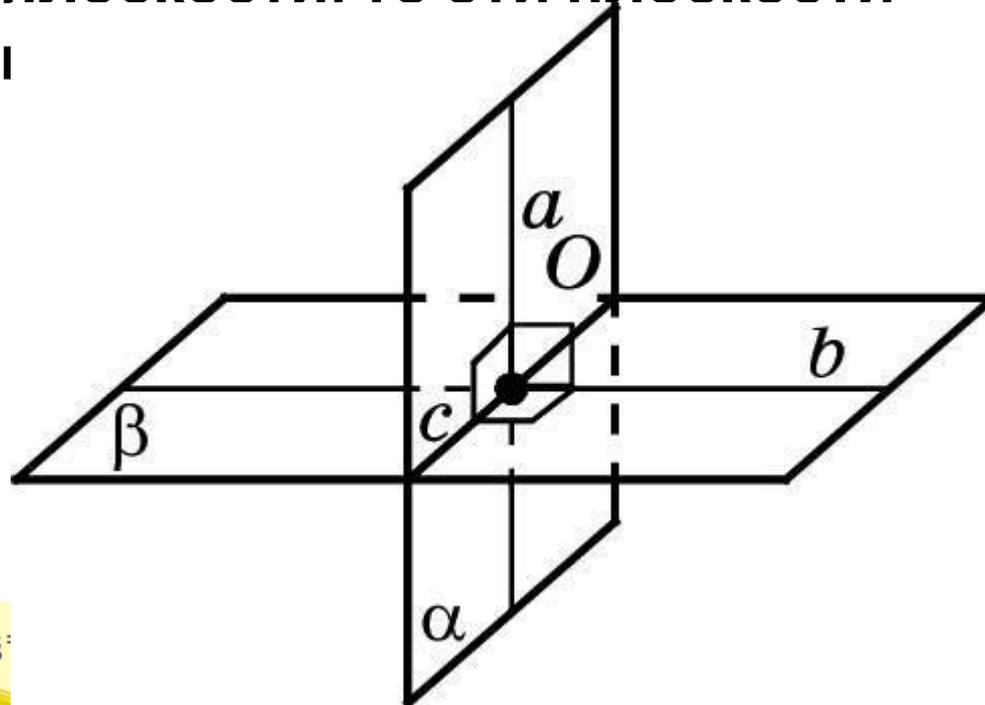
$$x = 70$$

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



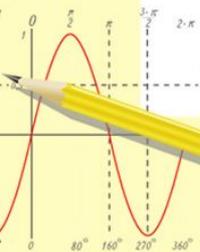
Признак перпендикулярности двух плоскостей.

Если одна из двух плоскостей проходит через прямую, перпендикулярную другой плоскости, то эти плоскости



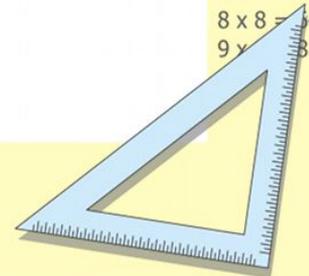
$$\begin{array}{r} 1 \\ \times 2500 \\ \hline 2500 \\ + 42 \\ \hline 210 \\ + 84 \\ \hline 105000 \end{array}$$

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

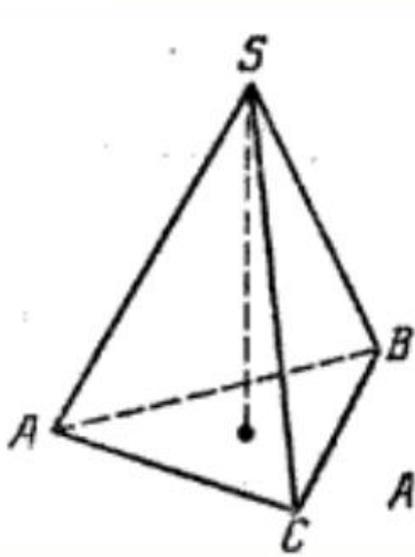


$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

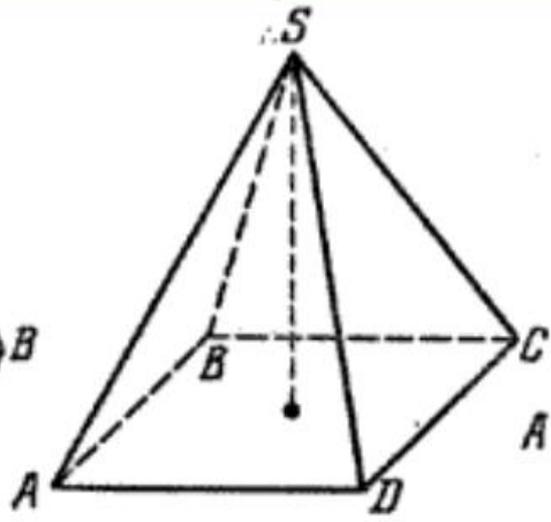
$$= x^2 - y^2$$



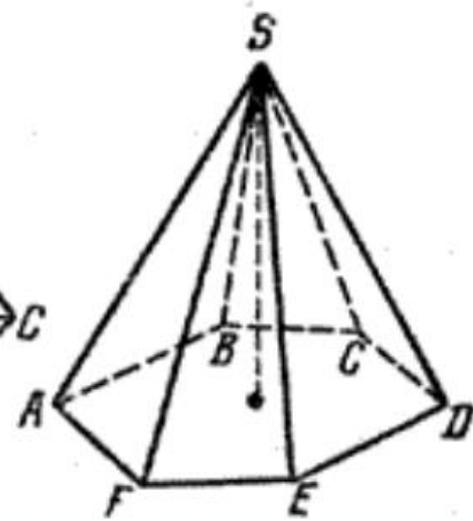
Правильные пирамиды



треугольная

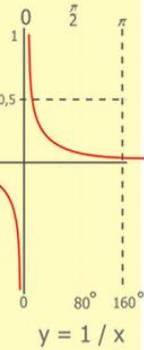
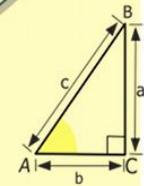
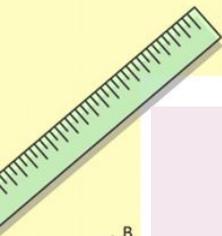


четырёхугольная

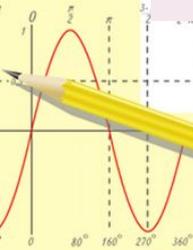


шестиугольная

- 1) Основание – правильный многоугольник
- 2) Основание высоты – центр многоугольника, лежащего в основании.



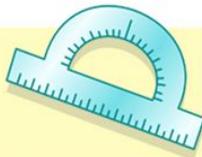
$$\begin{array}{r} 2500 \\ \times 42 \\ \hline 2100 \\ + 840 \\ \hline 105000 \end{array}$$



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

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

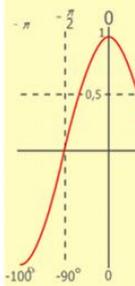
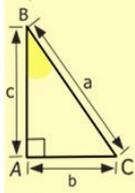
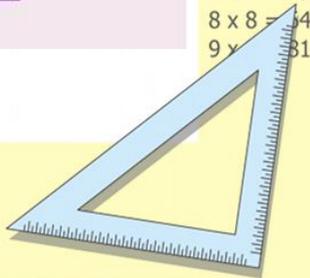
$$\sin 90^\circ = 1$$



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

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

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

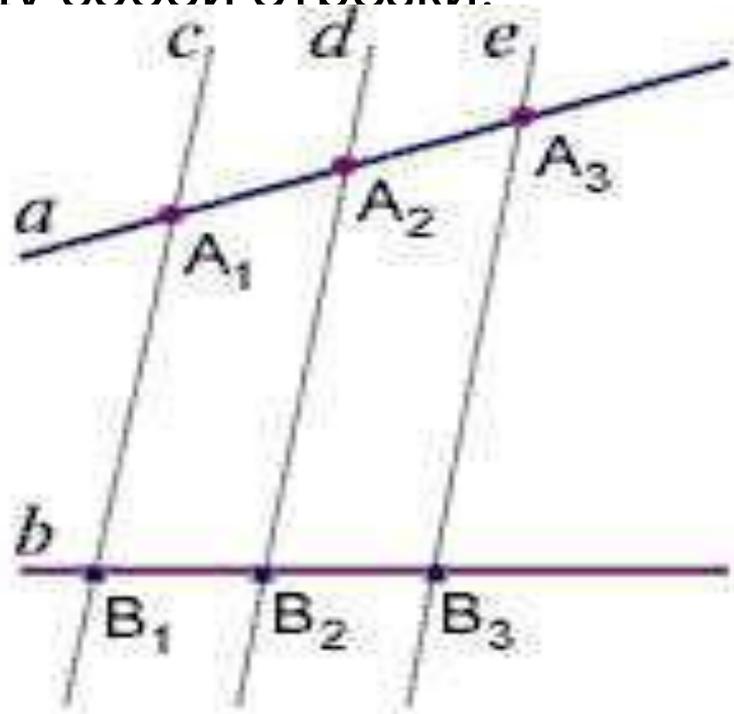


$$y = \cos$$

- 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

Теорема Фалеса

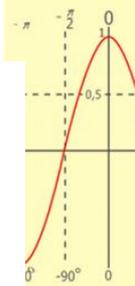
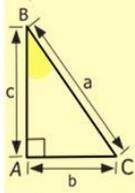
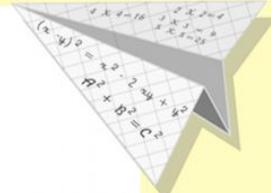
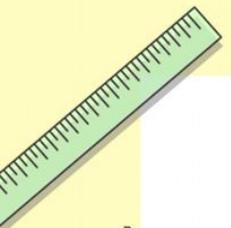
Если на одной из двух прямых отложить последовательно несколько равных между собой отрезков и через их концы провести параллельные прямые, пересекающие вторую прямую, то они отсекут на второй прямой равные между собой отрезки.



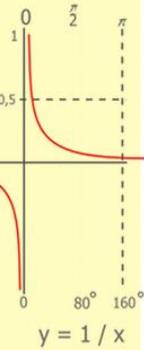
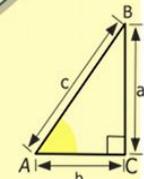
$$\frac{a}{A} = \frac{b}{B} = \frac{c}{C}$$

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

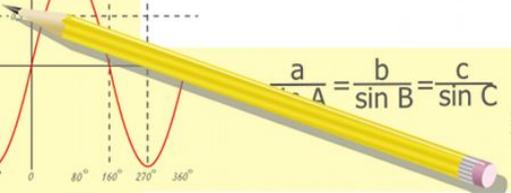
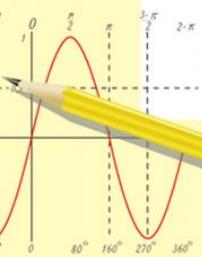
$\sin 90^\circ$



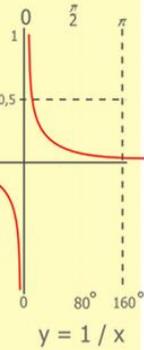
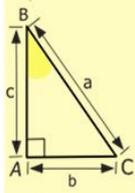
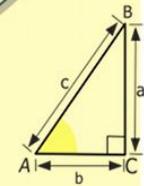
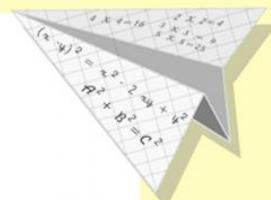
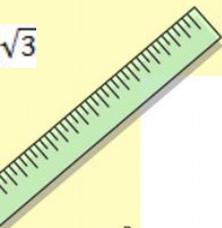
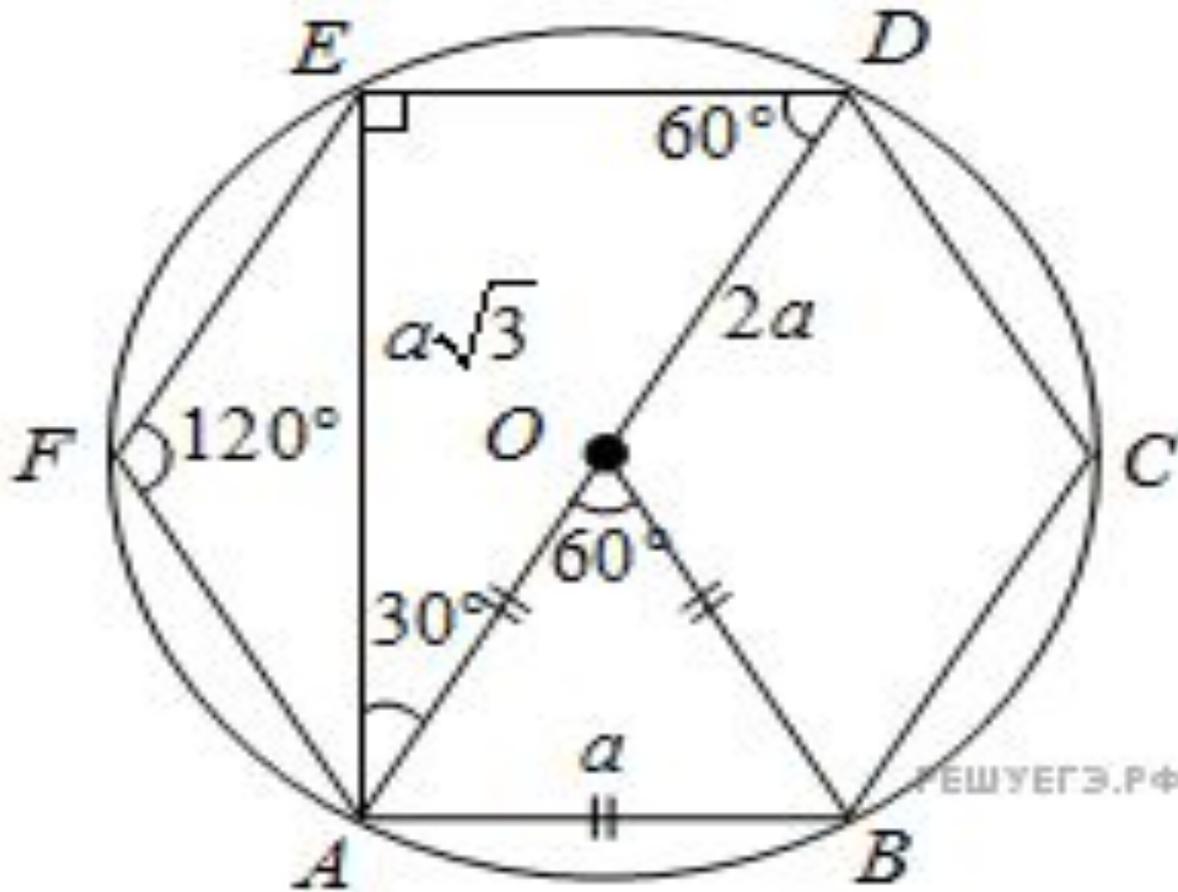
- x 2 = 4
- x 3 = 9
- x 4 = 16
- x 5 = 25
- x 6 = 36
- x 7 = 49
- x 8 = 64
- x 9 = 81



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

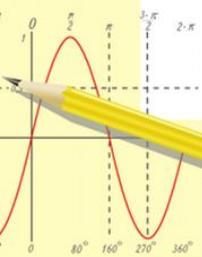


Свойства правильного шестигольника



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

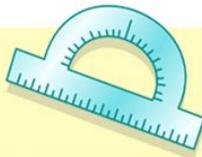
- $2 \times 2 = 4$
- $3 \times 3 = 9$
- $4 \times 4 = 16$
- $5 \times 5 = 25$
- $6 \times 6 = 36$
- $7 \times 7 = 49$
- $8 \times 8 = 64$
- $9 \times 9 = 81$



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

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

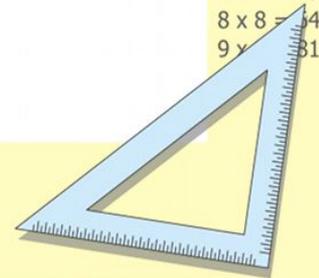
$\sin 90^\circ = 1$



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

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

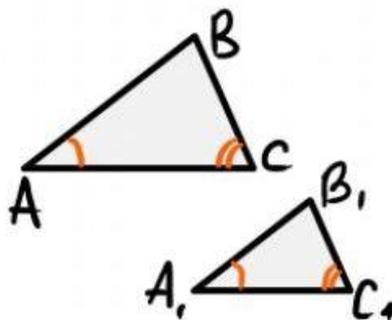
$(x+y)(x-y) = x^2 - y^2$



Признаки подобия треугольников

1 признак

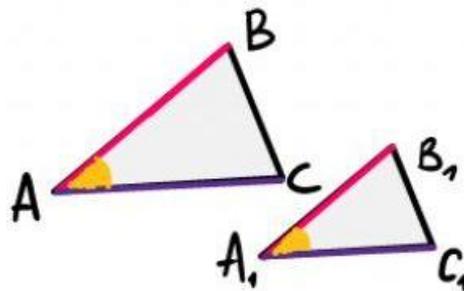
Если два угла одного треугольника соответственно двум углам другого треугольника,



то эти треугольники подобны

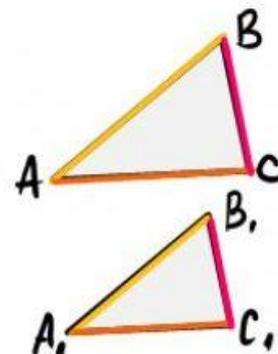
2 признак

Если две стороны одного треугольника пропорциональны двум сторонам другого треугольника, а углы, заключенными между этими сторонами



3 признак

Если три стороны одного треугольника пропорциональны трем сторонам другого треугольника,



LIVEWORKSHEETS

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

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

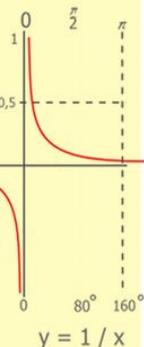
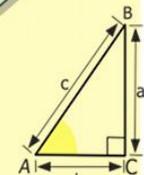
$$\sin 90^\circ = 1$$

$$x = 25y + 45$$

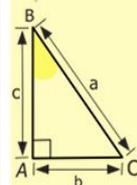
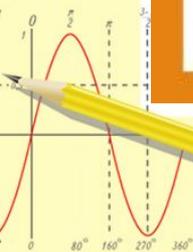
$$\begin{cases} y = 1 \\ x = 25 + 45 \end{cases}$$

$$x = 70$$

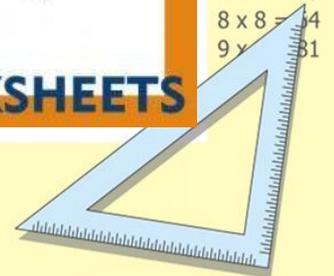
$$(x+y)(x-y) = x^2 - y^2$$



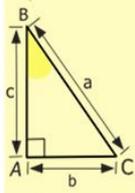
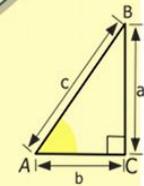
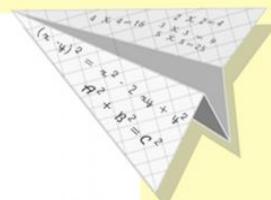
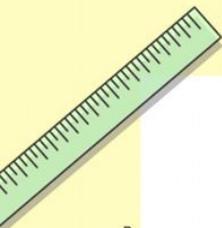
$$\begin{array}{r} 1 \\ \times 2500 \\ \times 42 \\ \hline 210 \\ + 84 \\ \hline 105000 \end{array}$$



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



Формулы для вычисления площади треугольника



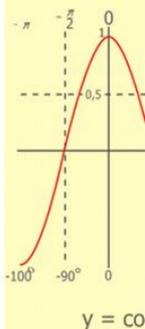
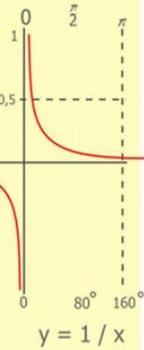
$$S = \frac{1}{2} a \cdot h_a$$

$$S = \frac{1}{2} ab \sin \alpha$$

$$S = \frac{a^2 \sin B \cdot \sin C}{2 \sin A}$$

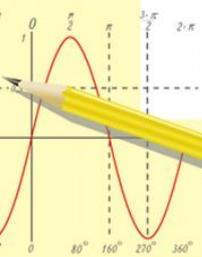
$$S = \frac{a^2 \sin(A + C) \cdot \sin C}{2 \sin A}$$

$$S = \sqrt{p(p - a)(p - b)(p - c)}; \quad p = \frac{a + b + c}{2}$$



$\frac{1}{2} 500$
 $\times 42$
 \hline
 210
 $+ 84$
 \hline
 105000

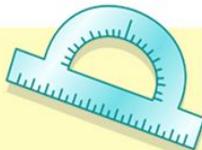
$2 \times 2 = 4$
 $3 \times 3 = 9$
 $4 \times 4 = 16$
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$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

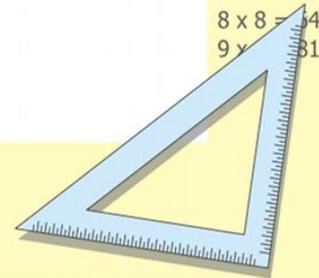
$$\sin 90^\circ = 1$$



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

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

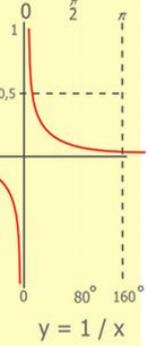
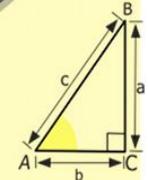
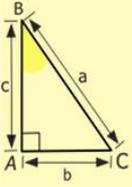
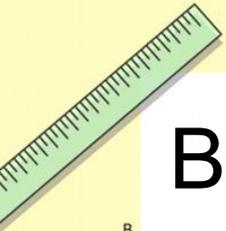
$$(x+y)(x-y) = x^2 - y^2$$



Задача

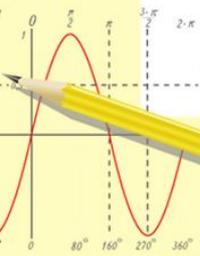
В правильной шестиугольной пирамиде $SABCDEF$ сторона основания AB равна 2, а боковое ребро SA равно 8. Точка M — середина ребра AB . Плоскость α перпендикулярна плоскости ABC и содержит точки M и D . Прямая SC пересекает плоскость α в точке K .

- а) Докажите, что $KM = KD$.
б) Найдите объём пирамиды $CDKM$.



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

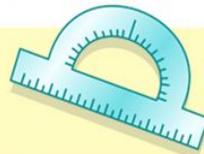
$$\begin{array}{l} 2 \times 2 = 4 \\ 3 \times 3 = 9 \\ 4 \times 4 = 16 \\ 5 \times 5 = 25 \\ 6 \times 6 = 36 \\ 7 \times 7 = 49 \\ 8 \times 8 = 64 \\ 9 \times 9 = 81 \end{array}$$



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

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

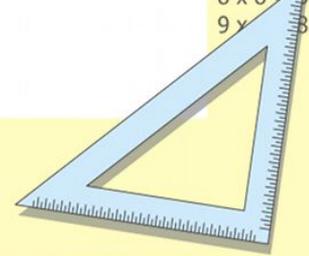
$$\sin 90^\circ = 1$$

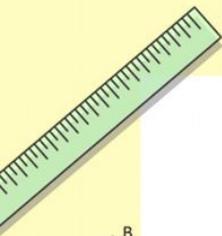


$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

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

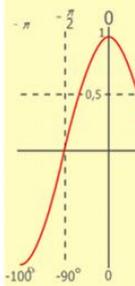
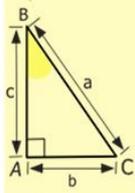
$$(x+y)(x-y) = x^2 - y^2$$



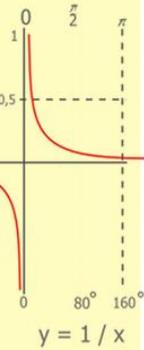
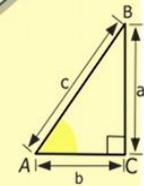
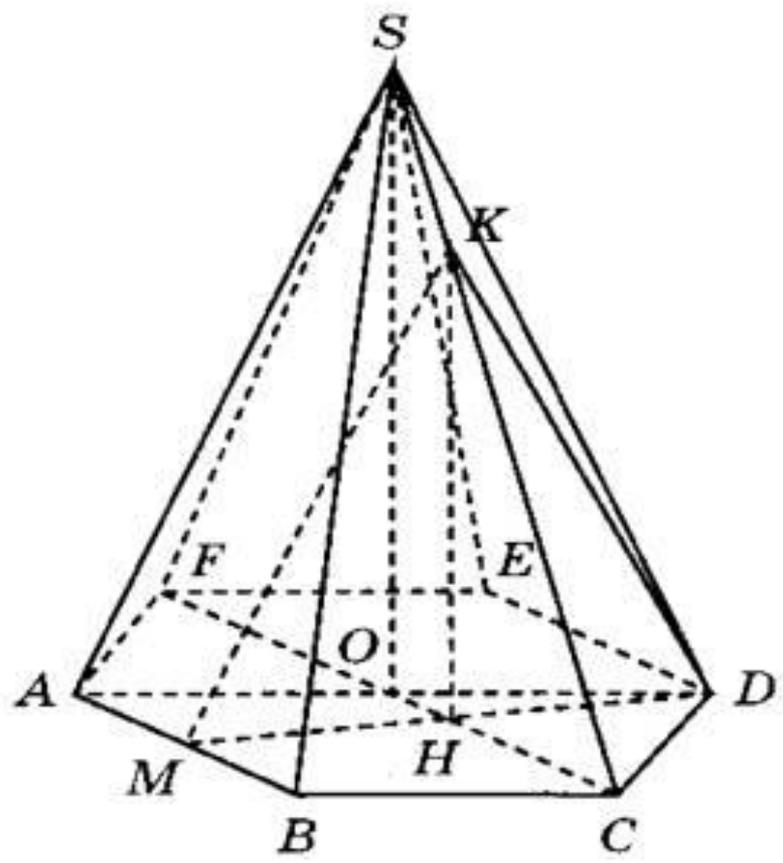


Дано:

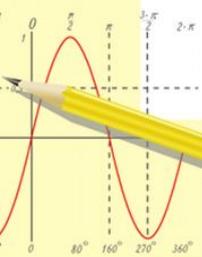
SAB CDEF-правильная пирамида, $AB=2$,
 $SA=8$, $M \in$ пл. альфа,
 $D \in$ пл. альфа,
 пл. альфа \perp (ABC)
 $SC \cap$ пл. альфа – K
 а) Д-ть, что $MK=DK$
 б) $V_{CDKM} = ?$



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



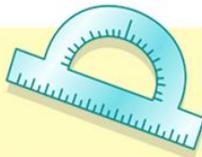
$$\begin{array}{r} 1 \\ \times 2500 \\ \hline 210 \\ + 84 \\ \hline 105000 \end{array}$$



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

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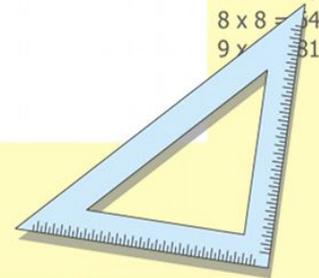
$$\sin 90^\circ = 1$$



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

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

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



Решение:

а) SO -высота пирамиды \Rightarrow
 $SO \perp (ABCDEF)$ (по опр. пр. пирамиды)

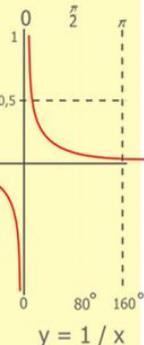
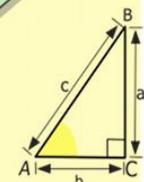
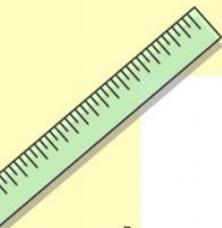
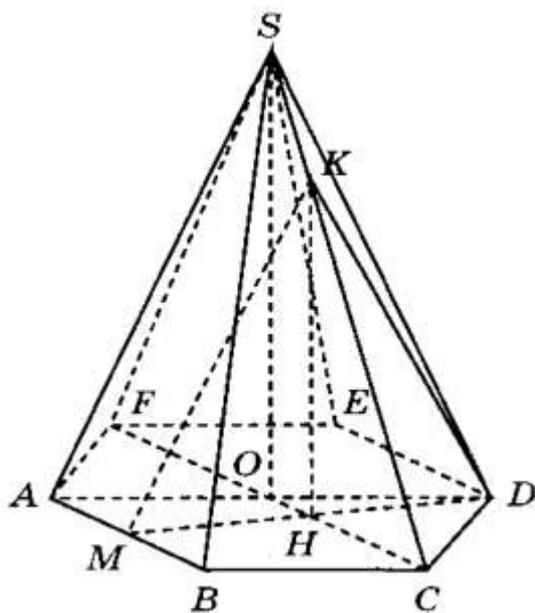
$SO \in (SCF) \Rightarrow$
 $(SCF) \perp ABCDEF$ (по признаку перпендикулярности плоскостей)

пл. альфа $\perp (ABC)$

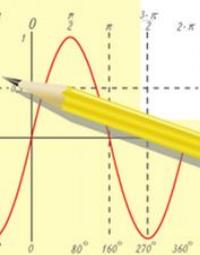
$(SCF) \cap$ пл. альфа $= KN \Rightarrow$

$KN \perp (ABCDEF)$ (по свойству перпендикулярности плоскостей) \Rightarrow

$KN \perp MD \Rightarrow KN$ -высота $\blacktriangle KMD$



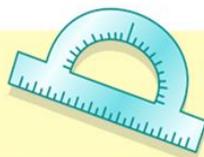
$$\begin{array}{r} 1 \\ \times 2500 \\ \times 42 \\ \hline 210 \\ + 84 \\ \hline 105000 \end{array}$$



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

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

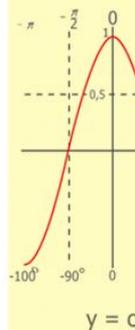
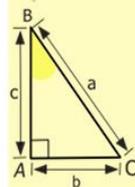
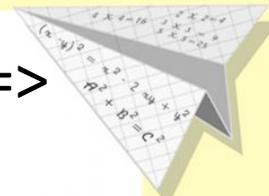


$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

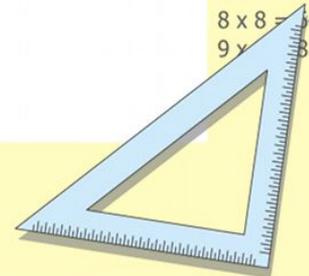
$$\begin{cases} y = 1 \\ x = 25 + 45 \end{cases}$$

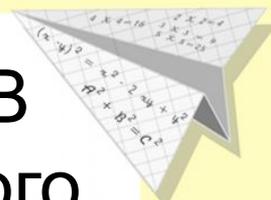
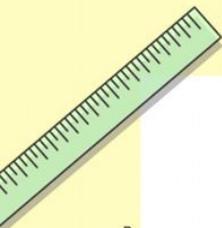
$$x = 70$$

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

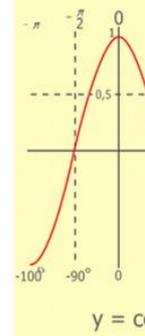
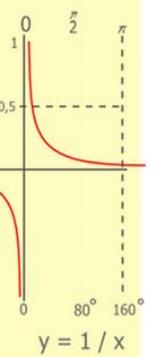
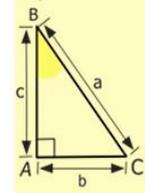
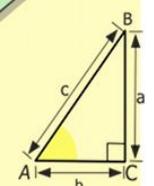
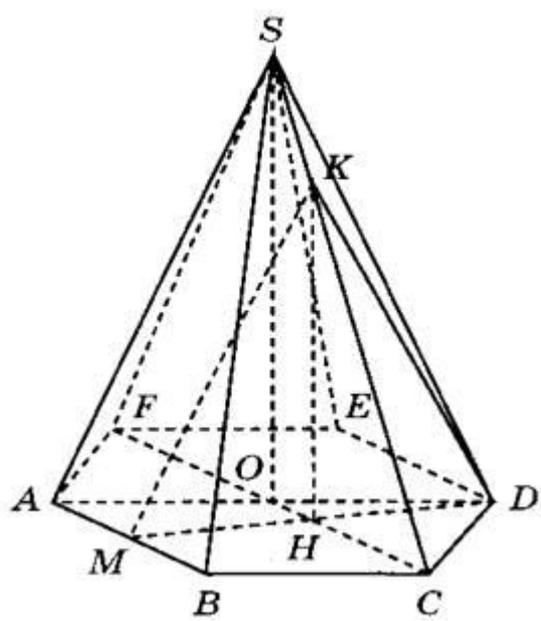


$$\begin{array}{l} 2 \times 2 = 4 \\ 3 \times 3 = 9 \\ 4 \times 4 = 16 \\ 5 \times 5 = 25 \\ 6 \times 6 = 36 \\ 7 \times 7 = 49 \\ 8 \times 8 = 64 \\ 9 \times 9 = 81 \end{array}$$



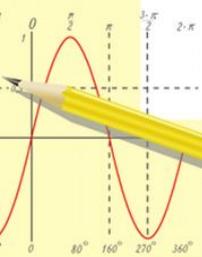


- O - середина AD, FC || AB (по свойству правильного шестиугольника) => H - середина MD (по т. Фалеса) => KH - медиана \blacktriangle KMD => \blacktriangle KMD - равнобедренный => MK = DK



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

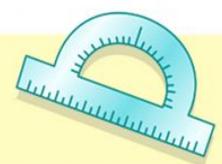
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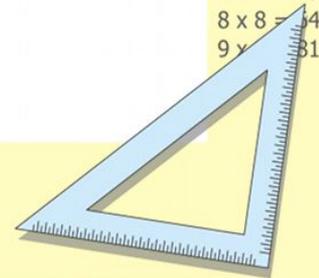
$$\sin 90^\circ = 1$$

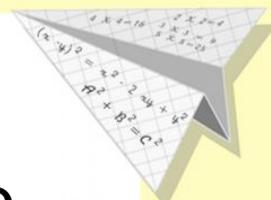
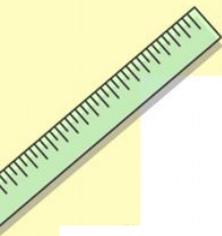


$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

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

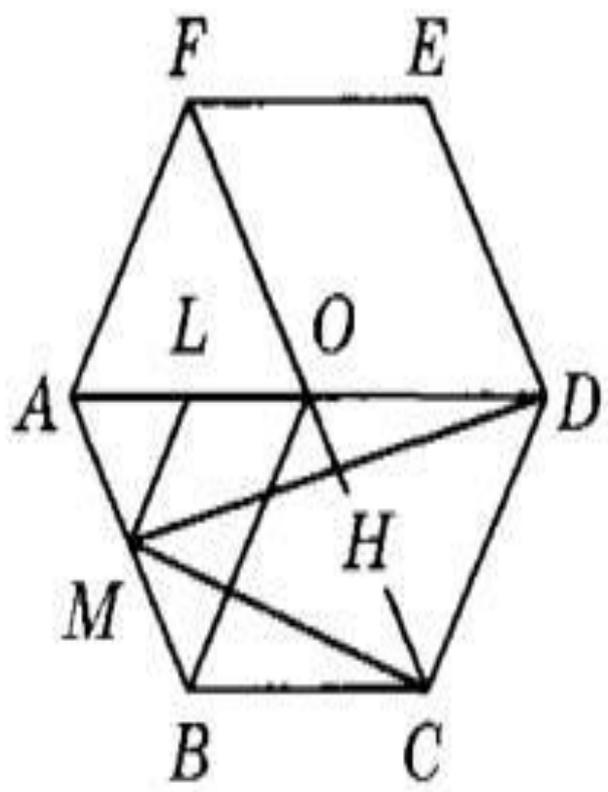
$$(x+y)(x-y) = x^2 - y^2$$





б) $V_{CDKM} = \frac{1}{3} * S_{\triangle DCM} * KH$

$S_{\triangle DCM}$ найдем по формуле Герона



$DC=2,$

MC по теореме косинусов

найдем из $\triangle BCM$

угол $\sqrt{7}$ 120 , $MB=1$, $BC=2$

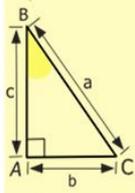
$MC=$

DM по теореме косинусов

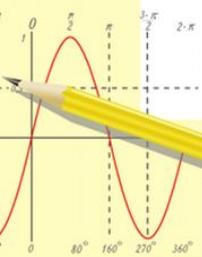
найдем из $\triangle ADM$, угол $A=6\sqrt{13}$

$AD=2 * \sqrt{3} * 2=4$, $AM=1$, $DM=$

$S_{\triangle DCM} = \frac{1}{2} * DC * MC * \sin 90^\circ = \frac{1}{2} * 2 * \sqrt{3} * 1 = \sqrt{3}$



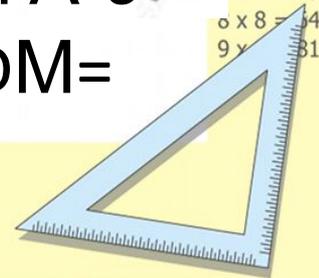
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$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
 $\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$

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

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



OC=AB(по свойству
правильного
шестиугольника)

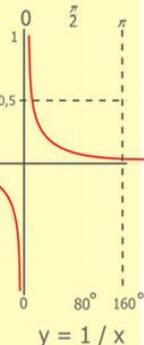
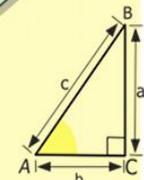
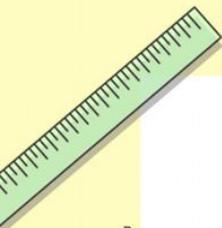
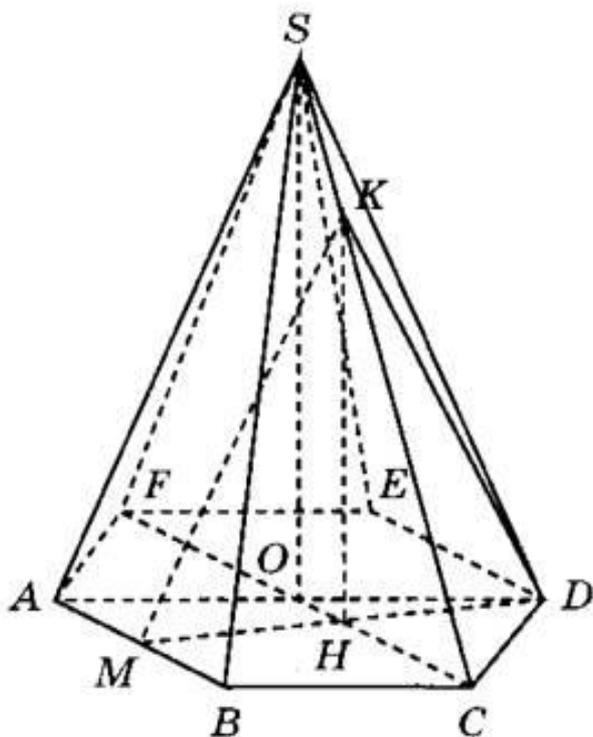
Найдем SO по теореме
Пифагора из $\triangle SOC$ $SO = ?$
 $\triangle SOC \sim \triangle KOC$ (по двум
углам)

$$KH = SO \cdot OH / OC$$

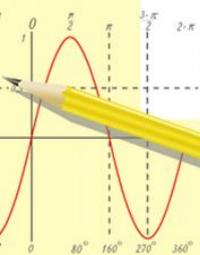
$$OH = 1/2 AM = 1/2 \cdot 1/2 AB = 0,5$$

$$KH = 3 \sqrt{15} / 2$$

$$V_{CDKM} = 1/3 \cdot \left(\frac{\sqrt{15}}{2} \cdot 3 \sqrt{3} \right) / 2 = 9 \sqrt{5} / 2$$



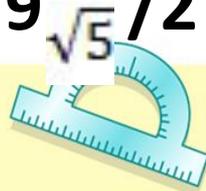
$$\begin{array}{r} 1 \\ \times 2500 \\ \times 42 \\ \hline 210 \\ + 84 \\ \hline 105000 \end{array}$$



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

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

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

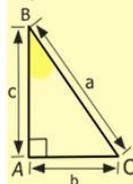
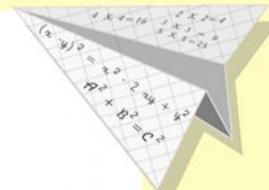


$$\begin{cases} y = \sin 90 \\ x = 25y + 45 \end{cases}$$

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

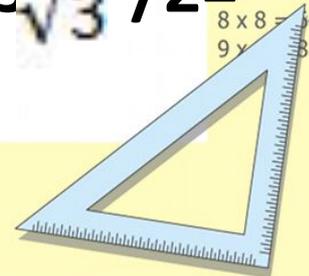
$$x = 70$$

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



$$y = \cos$$

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



ИСТОЧНИКИ:

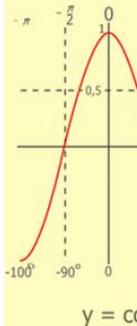
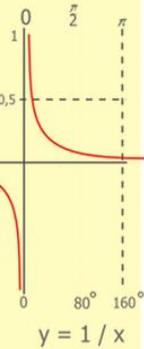
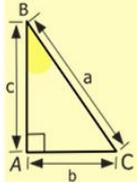
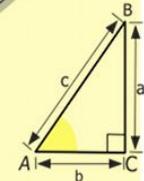
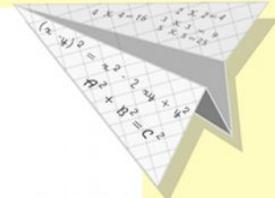
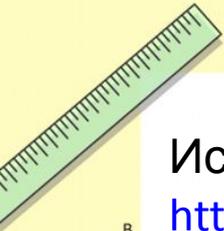
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https://ege.sdangia.ru/rus_sprav?ajax=1&id=596

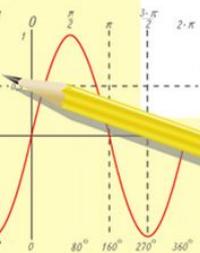
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$$\begin{array}{r} \frac{1}{2} 500 \\ \times 42 \\ \hline 2100 \\ + 84 \\ \hline 105000 \end{array}$$

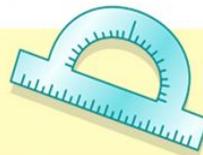
- 2 x 2 = 4
- 3 x 3 = 9
- 4 x 4 = 16
- 5 x 5 = 25
- 6 x 6 = 36
- 7 x 7 = 49
- 8 x 8 = 64
- 9 x 9 = 81



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

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

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



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

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

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

