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CIRCLE. POSITION OF A CIRCLE ON A PLANE. PROBLEMS RELATED TO A CIRCLE.

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Аннотация: Эта статья дает общеепредставление о круге. Также имеется понимание состояний окружностей на плоскости и уравнения окружности. С их помощью объяснялись пути решения проблем.

Ключевые слова: Окружность, объём, радиус, концентрические окружности, диаметр, уравнение окружности, попытка, прямая, плостксть .

Annostasion: This article provides a general understanding of the circle. There is also an understanding jf the states of the circles on the plane and the equation of the circle. Using them, the solutions to the problem were explained.

Key words: Circle, volume, radius, concentric circles, diametr, circle equation, attempt, straiglit line, plane.

Definition: A circle is a figure consisting of points that lie equidistant from a given point in a plane.

A given point is called the center of the circle. The line segment joining any two points on the circle is called its tangent. The line segment passing through the center of the circle is called its diameter. The line segment joining the center of the circle and any point on the circle is called its radius.

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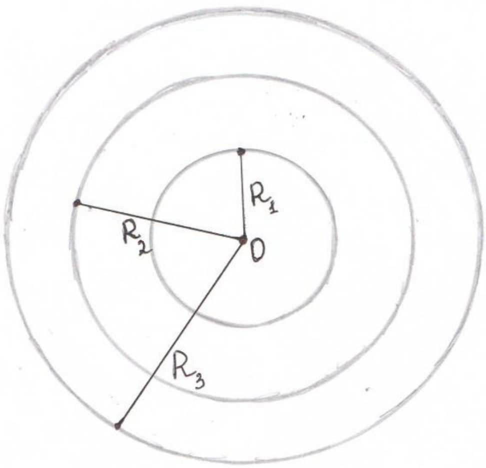
Circles whose centers overlap are called concentric circles. These circles differ from each other

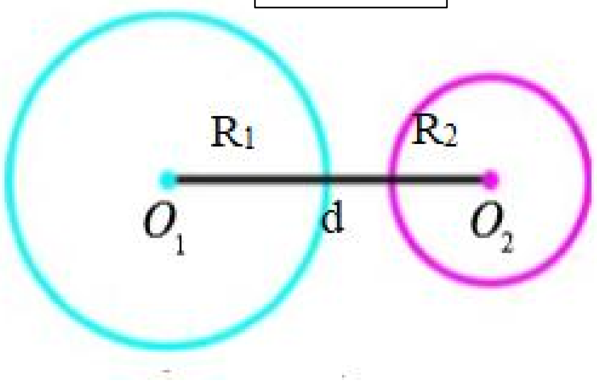


only in their radii.

The mutual location of two circles on a plane.

We are given two circles, whose centers are O1 and O2 and whose radii are R1 and R2, respectively. Let the distance between the centers of these circles be O1O2=d.

Case 1. If , $\boxed{d > R_1 + R_2}$ the circles have no common point and lie outside each other.



$\boxed{d < R_1 + R_2}$ are also cases where the circles lie inside each other without having a common point.

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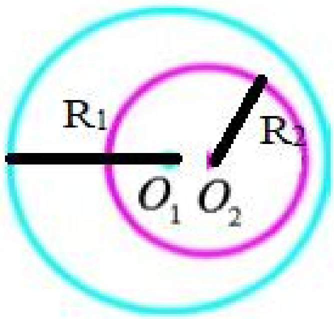
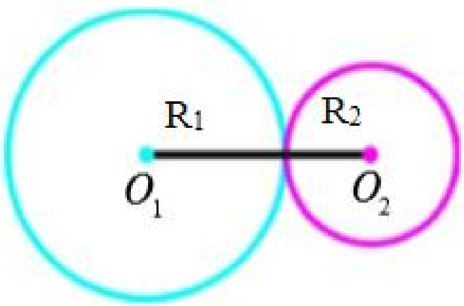
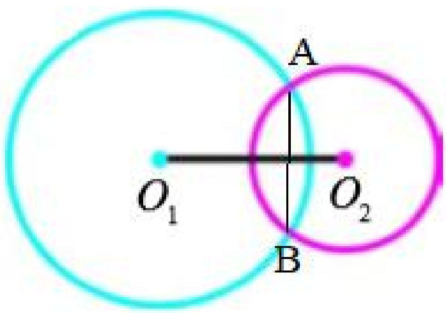


Case 2. If d= R1+ R2, then two circles have one common point. In this case, the circles are said to be congruent.



There are also cases where two circles are internal to each other. In this case, one of the circles lies inside the other.

Case 3. If $d< R_1 + R_2$ les have two common points, then these circles are said to intersect.



Intersecting circles have a common tangent. The line AB in the diagram is a common tangent. $O_1O_2 \perp AB$ AE=EB

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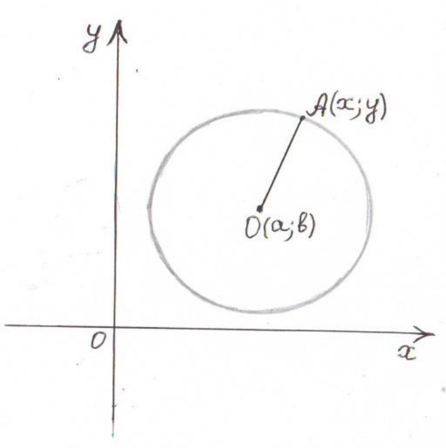
Equation of a circle

Note. We A(x_1;y_1) va B(x_2;y_2) the distance between points AB=$\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ We learned to express it with a formula , $(x_2-x_1)^2+(y_2-y_1)^2$ =AB^2 will be . Now consider a circle with center at point O(a;b) and radius R. Let point A(x;y) be an arbitrary point on this circle.



Any point on a circle lies at the same distance from its center and satisfies this equality.

This equation is the general equati $\boxed{(x-a)^2+(y-b)^2=R^2}$ radius R.

Note. $(x-a)^2+(y-b)^2 \le R^2$ The inequality represents a circle with the center at the point O(a;b) and radius R.

Problem . In the coordinate plane $x^2+y^2 \le 8|y|$ Find the area of the figure given by the inequality.

Case 1. y>0 if ,

$x^2+y^2 \le 8|y|$

$x^2+y^2-8y+16 \le 16$

$x^2+(y-4)^2 \le 16$

O(0;4) R=4 $S_1=16\pi$

Case 2 . y<0 if ,

$x^2+y^2 \le -8|y|$

$x^2+y^2+8y+16 \le 16$

$x^2+(y+4)^2 \le 16$

O(0;-4) R=4 $S_2=16\pi$

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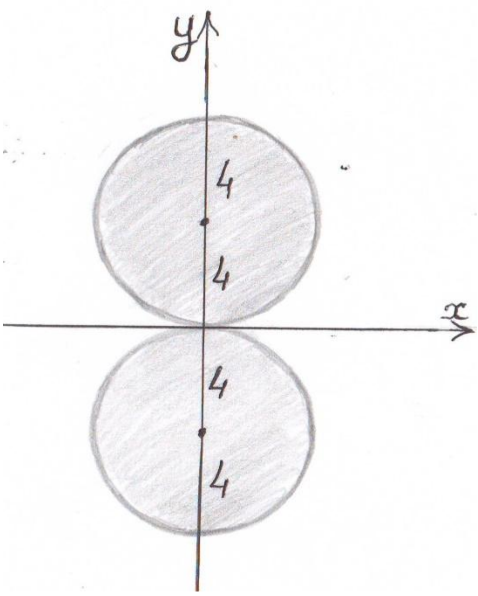
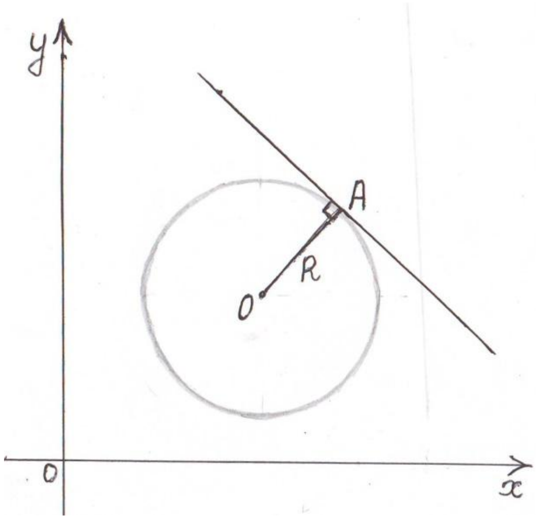


Problems

1. Construct the equation of a circle tangent to the three straight lines x+y-2=0, x-y+4=0, x-7y=0.

Solution: Theorem: A straight line tangent to a circle is perpendicular to the radius drawn to the point of the tangent.



We use the formula for the shortest distance from a point to a straight line to work out the above problem:

$$\rho = \frac{|Ax_0+By_0+C|}{\sqrt{A^2+B^2}} \qquad (1)$$

In this formula, the equation of the straight line Ax+By+C=0, (x0;y0) are the coordinates of the point.

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We depict straight lines on the coordinate axis.

1) x+y-2=0 x=0 da y=2

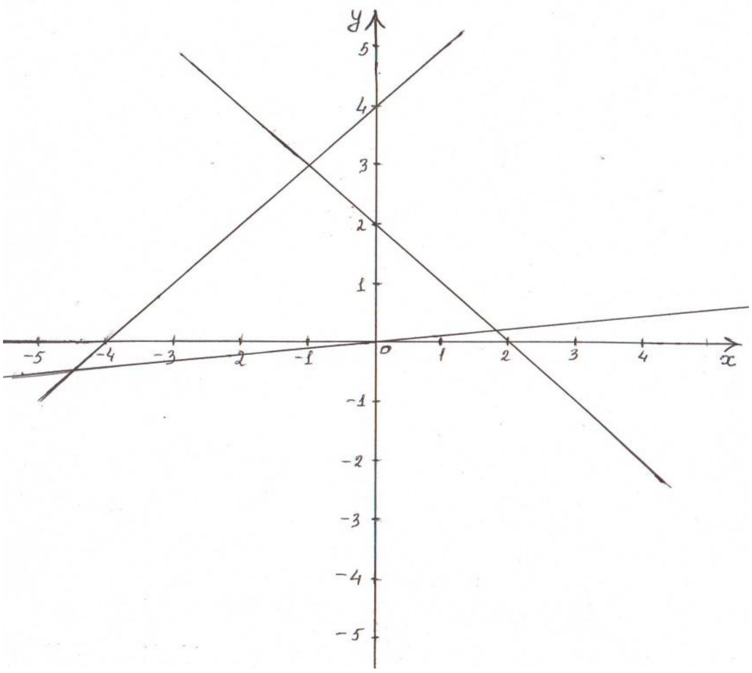
y=0 da x=2

2) x-y+4=0 x=0 da y=4

y=0 da x=-4

3) x-7y=0 x=0 da y=0

y=0 da x=0 b $y = \frac{1}{7}x$



To use formula (1), we define the coordinates of the center of the circle as (x0;y0) and derive the following equations:

$\frac{|x_0+y_0-2}{\sqrt{2}} = \frac{|x_0-y_0+4}{\sqrt{2}} = \frac{|x_0-7y_0|}{5\sqrt{2}} = \mathrm{R}$ R-radius of the circle.

We continue the solution as a system:

$$\textbf{1)} \begin{cases} x_0 + y_0 - 2 = x_0 - y_0 + 4 \\ 5(x_0 + y_0 - 2) = x_0 - 7y_0 \end{cases} \Rightarrow \begin{cases} y_0 = 3 \\ 5x_0 + 15 - 10 = x_0 - 21 \end{cases} \Rightarrow$$

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$$\begin{cases} y_0 = 3 \\ 4x_0 =- 26 \end{cases} \Rightarrow \begin{cases} y_0 = 3 \\ x_0 =- \frac{13}{2} \end{cases}$$

So the center of the circle is at $(\frac{13}{2};3)$ Now we find the radius of the circle.

R= $\frac{|-\frac{13}{2}+3-2|}{\sqrt{2}} = \frac{|\frac{-13+2}{2}}{\sqrt{2}} = \frac{11}{2\sqrt{2}}$

Equation of a circle$(x+\frac{13}{2})^2 + (y-3)^2 = \frac{121}{8}$

2) $\begin{cases} x_0 + y_0 - 2 = -x_0 + y_0 - 4 \\ 5(x_0 + y_0 - 2) =- x_0 + 7y_0 \end{cases} \Rightarrow \begin{cases} 2x_0 =- 2 \\ 5x_0 + 5y_0 - 10 + x_0 - 7y_0 = 0 \end{cases}$

$\Rightarrow \begin{cases} x_0 =- 1 \\ 6x_0 - 2y_0 = 10 \end{cases} \Rightarrow \begin{cases} x_0 =- 1 \\ y_0 =- 8 \end{cases}$ R= $\frac{|-1-8-2|}{\sqrt{2}} = \frac{11}{\sqrt{2}}$

Equation of a circle $(x+1)^2 + (y+8)^2 = \frac{121}{2}$

3) $\begin{cases} x_0 + y_0 - 2 = -x_0 + y_0 - 4 \\ 5(x_0 + y_0 - 2) = x_0 - 7y_0 \end{cases} \Rightarrow \begin{cases} 2x_0 =- 2 \\ 4x_0 + 12y_0 = 10 \end{cases} \Rightarrow \begin{cases} x_0 =- 1 \\ 12y_0 = 14 \end{cases} \Rightarrow \begin{cases} x_0 =- 1 \\ y_0 = \frac{7}{6} \end{cases}$

R= $\frac{|-1+\frac{7}{6}-2|}{\sqrt{2}} = \frac{11}{6\sqrt{2}}$

Equation of a circle$(x+1)^2 + (y-\frac{7}{6})^2 = \frac{121}{72}$

4) $\begin{cases} x_0 + y_0 - 2 = x_0 - y_0 + 4 \\ -5x_0 - 5y_0 + 10 = x_0 - 7y_0 \end{cases} \Rightarrow \begin{cases} 2y_0 = 6 \\ 2y_0 + 10 = 6x_0 \end{cases} \Rightarrow \begin{cases} y_0 = 3 \\ x_0 = \frac{8}{3} \end{cases}$

R= $\frac{|\frac{8}{3}+3-2|}{\sqrt{2}} = \frac{11}{3\sqrt{2}}$

Equation of a circle $(x-\frac{8}{3})^2 + (y-3)^2 = \frac{121}{18}$

So there are 4 circles we are looking for.

2. The circle that passes through the points (1;1) , (0;2) and $(x-5)^2 + (y-5)^2 = 16$ Let the equation of the circle be constructed.

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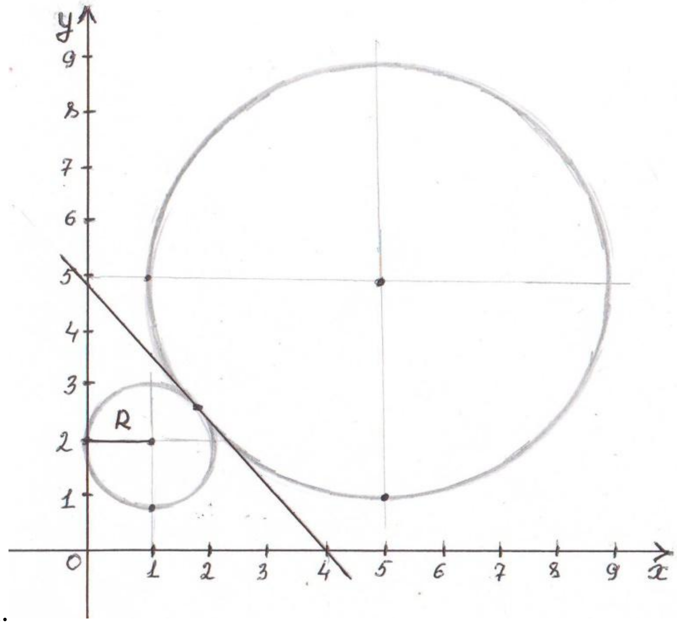
Solution: Let the center of the unknown circle be O(h;k). The distance between the centers of the intersecting circles is equal to the sum or difference of their



radi.

But it can be seen from the graph that the unknown circle is an exterior circle to the given circle (i.e., since the points (1;1) and (0;2) lie outside the circle $(x-5)^2+(y-5)^2=16$ (because it is located outside the circle) the unknown circle is external to the given circle.

1) $(x-5)^2+(y-5)^2=16$ The circle has center (5;5) and radius R1=4

2) We write two equations through the point O(h;k) with center and (1;1) , (0;2):

$(h-1)^2+(k-1)^2=R_2^2$ $\qquad$ $h^2+(k-2)^2=R_2^2$

$h^2-2h+1+k^2-2k+1=h^2+k^2-4k+4$

$2k-2h-2=0$ $\qquad$ $\boxed{k-h=1}$ n .

$h^2-2h+1+k^2-2k+1$

3) Distance between centers:

$\sqrt{(h-5)^2+(k-5)^2}=R_2+4$

$h^2-10h+25+k^2-10k+25=(R_2+4)^2$

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$h^2-10h+50+(1+h)^2-10(1+h)=(R_2+4)^2$

$h^2-10h+50+1+2h+h^2-10-10h=(R_2+4)^2$

$2h^2-18h+41=(R_2+4)^2$

If we draw the diagram clearly, it becomes clear that the radius $\boxed{R_2=1}$ he circle is unknown.

$2h^2-18h+41=25 \Rightarrow 2h^2-18h+16=0 \Rightarrow h^2-9h+8=0 \Rightarrow D=81-32=49$

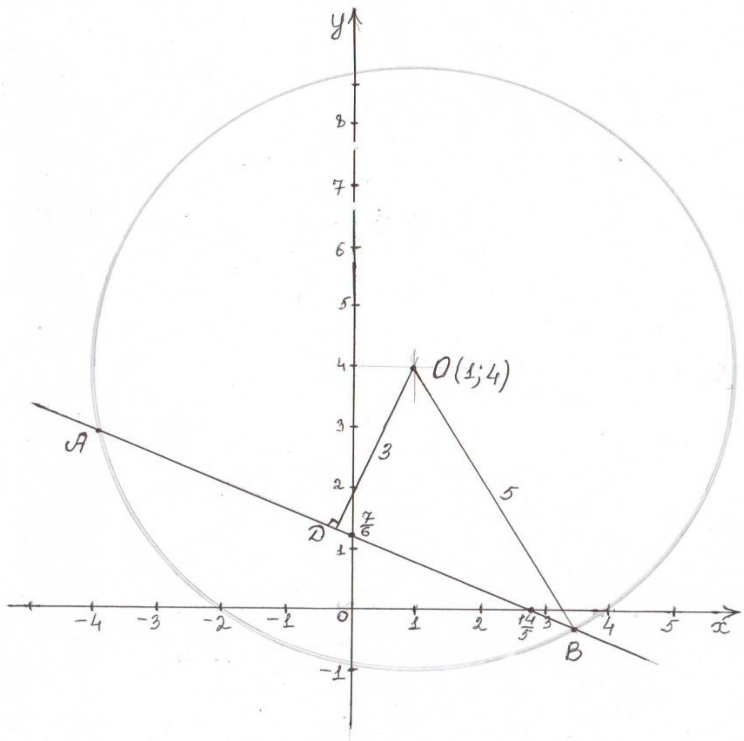
$h_1=\frac{9+7}{2}=\underline{8}$ chet

$h_2=1$ $k=2$ ekan .

So, the equation of the unknown circle is as follows::

$$\boxed{(x-1)^2+(y-2)^2=1}$$

3. $x^2+y^2-2x-8y-8=0$ aylana $5x+12y-14=0$ Find the length of the line formed by its intersection



with the straight line.

$5x+12y-14=0$ We depict a straight line on a graph..

x=0 da $y=\frac{7}{6}$

y=0 da $x=\frac{14}{5}=2,8$

$(x^2-2x+1)+(y^2-8y+16)=17+8$

$(x-1)^2+(y-4)^2=5^2$ O(1;4) R=5 We find the shortest distance from the point O(1;4) to the straight line 5x+12y-14=0. $\rho=\frac{|5\cdot 1+12\cdot 4-14|}{13}=\frac{39}{13}=3$ OB =R = 5 Since, according to the Pythagorean theorem, OD = 4. So AB = 8.

Answer: 8 .

References to literature:

1. A'zamov A., B. Haydarov. Math sayyorasi. Toshkent. "The Teacher", 1993.

2 .BaxvalovS.V. Collection of problems from analytic geometry Tashkent -2005

3. Aleksandrov A.D. "Geometry -9", textbook, Moscow. Enlightenment", 2013.

4. Atanasyan S. "Geometry 7-9 classes", textbook, Moscow. Enlightenment", 2002.

5. Bevz G.P. et al. "Geometry 9" textbook, Kiev, "Tower", 2007

6. Bilyanina O.Ya. et al. "Geometry 8" textbook, Kiev, "Genesis", 2010.

7. Ister O.S. "Geometry 9" textbook, Kiev, Osvita, 2007.

8. Merzlyak A.G. et al., "Geometry 9" textbook, Kharkov, Gymnasium, 2008.

9. Perelman Ya.I. Limited Geometry, Toshkent. The Teacher, 1981.

10. Pogorelov A.V. "Geometry 7-9", textbook, Moscow. Enlightenment", 2004.

11. Steinhaus G. Mathematical Kaleidoscope, Moscow. Science, 1993.

12. Daniel C.Alexander, Elementary geometry for college students, Canada, Brooks/ Cole, Cengage Learning, 2011.

13. Mal Coad and others, Mathematics for the international students, Haese and Harris publocations, Australia, 2010.

14. Jennie M. Bennett, “Pre-Algebra” Holt, Rinehart and Winston, New York, 2004

15. http://www.uzedu.uz - Xalq ta'limi vazirligining axborot ta'lim portal.

16. http://www.eduportal.uz - Multimedia markazi axborot ta'lim portal.

17. http://www.matematika.uz - Masofadan turib o‘qitish site (in Uzbek).

18. http://www.problems.ru/ List of problems from mathematics (in Russian).