10 Academic **Date:**

Day 9: The Equation of a Circle **Unit 2&3: Analytic Geometry**

The Circle

Warm-Up:

Are You Smarter Than an 8th Grader?

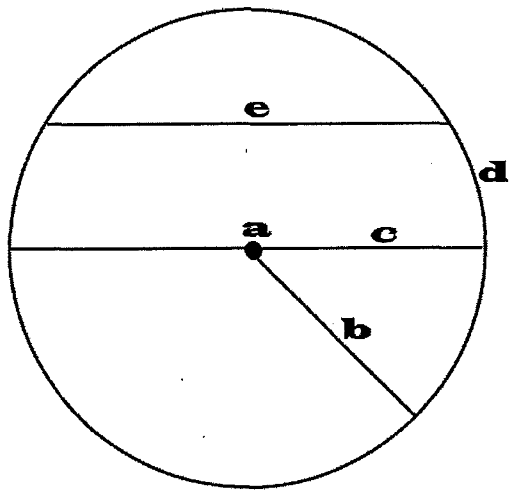
a = Centre

b = radius

c = diameter

d = circumference

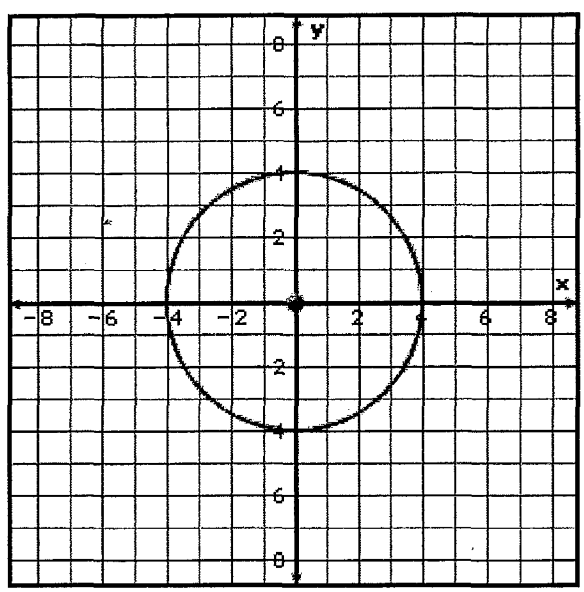
e = chord.



- The **radius** (r) is the distance from the centre of a circle to a point on the circle.
- All points on the **circumference** of the circle are equidistant (r units) from the centre.

Task 1: The Circle Formula

On the screen, you should see the following circle.



1. What are the coordinates of the centre of the circle?

(0 , 0)

In the equation at the top: $(x-h)^2+(y-k)^2=r^2$, the value of h and k are the coordinates of the centre of the circle. In this exercise, our centre will always be (0, 0), so the equation will be in the form: $x^2+y^2=r^2$.

2. Write down the equation of this circle shown on the grid . $x^2+y^2=4^2$ or 16

3. Sketch a circle with radius 6 on the same grid and write the equation here. $x^2+y^2=36$

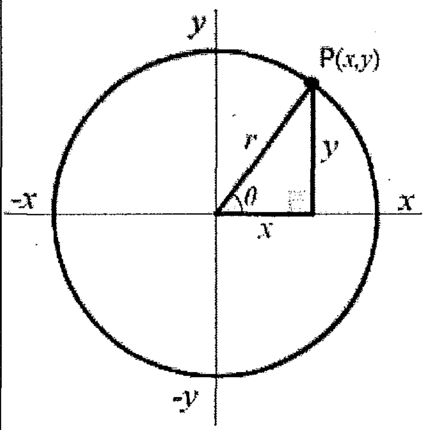
4. Sketch a circle on the same grid with radius 2 and write the equation here. $x^2+y^2=4$

5. What does the 'r' value stand for in the equation? radius

6. What is the radius of a circle with the equation $x^2+y^2=7^2$? radius = 7

7. What would be the equation of a circle with centre (0, 0) and radius of 5? $x^2+y^2=25$

8. What would happen to the graph of the circle if $r=0$? single point (0, 0)



Summary: fill in the missing information

Due to the Pythagorean Theorem (and thus the length of a line segment formula as well!), the equation of a circle with centre at (0, 0) and radius r is:

$x^2+y^2=r^2$

Task 2: Applications

A point lies on the circumference of a circle if the distance between the point and the center of the circle is equal to the radius.

9. Use the formula to determine the equation of a circle with centre (0, 0) if the point (5, 2) is on the circumference.

Substitute the point (5, 2) into the equation for x and y.

Solve the equation for r. $x^2+y^2=r^2$

$5^2+2^2=r^2$

Substitute the r back into the formula. $r^2=25+4=29$

$r=\sqrt{29}$

$\therefore\ x^2+y^2=(\sqrt{29})^2 \Rightarrow x^2+y^2=29$

10. Point A(2, 4) is on a grid.

a. If a circle is drawn and point A is INSIDE the circle, what could the equation be? How could you show this by using the circle formula?

$x^2+y^2=r^2$

$2^2+4^2=r^2$

$r^2=20$

$\therefore$ If A is inside the circle, r^2 must be less than 20.
one equation can be $x^2+y^2=16$

b. If a circle is drawn and point A is OUTSIDE the circle, what could the equation be? How could you show this by using the circle formula?

$x^2+y^2=r^2$ where $r^2>20$

eg. $x^2+y^2=25$.

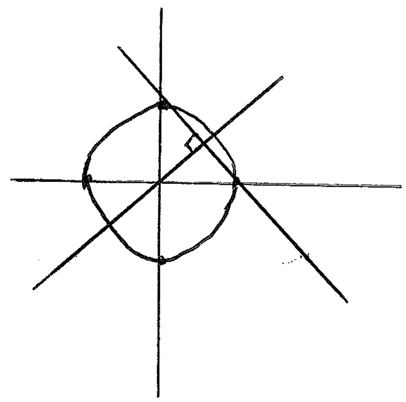
Day 10 **Verifying Properties of Circles**

1. *The right bisector of a chord of a circle passes through the centre of the circle.*

A chord is a line segment whose enpoints are on the circle.

On the circle

- construct a chord
- construct the right bisector of the chord

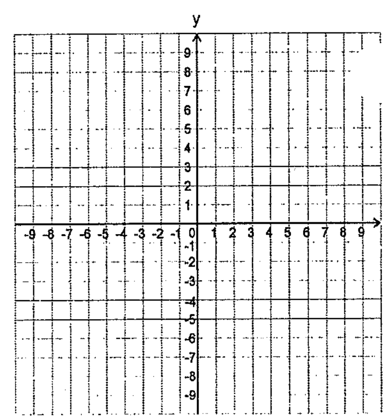


The right bisector passes through the centre

Example:

A circle has the equation $x^2 + y^2 = 25$. The points $A(-3,4)$ *and* $B(5,0)$ are endpoints of chord AB. Verify that the centre of the circle lies on the right bisector of chord AB.

Right Bisector: we need to use midpoint and $m_{\perp}$



$$M_{AB} = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) = \left(\frac{-3+5}{2}, \frac{4+0}{2}\right)$$

$$= (1, 2)$$

$$m_{AB} = \frac{y_2-y_1}{x_2-x_1} = \frac{0-4}{5+3} = \frac{-4}{8} = \frac{-1}{2}$$

$m_{\perp} = 2$ point $(1,2)$

$$y = m(x-x_1) + y_1$$

$$= 2(x-1) + 2$$

$$= 2x - 2 + 2$$

$$\boxed{y = 2x}$$

Centre $(0,0)$ $eq^n: y = 2x$

LS	RS
y	$2x$
0	$2(0)$
0	0

LS = RS

$\therefore$ $(0,0)$ is on the right bisector.