

WHAT IS THE EQUATION OF A CIRCLE WHOSE CENTER AT (-5, -2) AND RADIUS IS 2?

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UNDERSTANDING THE EQUATION OF A CIRCLE IS FUNDAMENTAL IN COORDINATE GEOMETRY, A BRANCH OF MATHEMATICS THAT DEALS WITH POINTS, LINES, AND SHAPES ON THE COORDINATE PLANE. WHEN GIVEN SPECIFIC CHARACTERISTICS SUCH AS THE CENTER AND RADIUS, DERIVING THE EQUATION BECOMES STRAIGHTFORWARD. IN THIS ARTICLE, WE WILL EXPLORE THE DETAILED PROCESS OF FINDING THE EQUATION OF A CIRCLE WITH A CENTER AT (-5, -2) AND A RADIUS OF 2, ALONG WITH RELATED CONCEPTS, FORMULAS, AND EXAMPLES TO ENHANCE YOUR UNDERSTANDING.

FUNDAMENTALS OF THE EQUATION OF A CIRCLE

BEFORE DIVING INTO THE SPECIFICS OF THE PROBLEM, IT'S ESSENTIAL TO UNDERSTAND THE GENERAL FORM OF A CIRCLE'S EQUATION AND THE GEOMETRIC PRINCIPLES BEHIND IT.

THE STANDARD EQUATION OF A CIRCLE

THE STANDARD FORM OF A CIRCLE'S EQUATION IN THE CARTESIAN COORDINATE PLANE IS:

PLAINTEXT

$$(x - h)^2 + (y - k)^2 = r^2$$

PLAINTEXT

WHERE:

- (h, k) ARE THE COORDINATES OF THE CIRCLE'S CENTER.
- r IS THE RADIUS OF THE CIRCLE.

THIS FORMULA REPRESENTS ALL POINTS (x, y) THAT ARE EXACTLY A DISTANCE r FROM THE CENTER (h, k).

GEOMETRIC INTERPRETATION

- THE CENTER OF THE CIRCLE IS THE FIXED POINT (h, k).
- THE RADIUS r IS THE DISTANCE FROM THE CENTER TO ANY POINT ON THE CIRCLE.
- THE SET OF ALL POINTS SATISFYING THE EQUATION FORMS A PERFECTLY ROUND SHAPE IN THE PLANE.

DERIVING THE EQUATION FOR THE GIVEN CIRCLE

GIVEN:

- CENTER: (-5, -2)
- RADIUS: 2

WE WILL SUBSTITUTE THESE VALUES INTO THE STANDARD FORM TO FIND THE SPECIFIC EQUATION.

STEP-BY-STEP CALCULATION

1. IDENTIFY THE PARAMETERS:

- $h = -5$
- $k = -2$
- $r = 2$

2. WRITE THE GENERAL FORMULA:

$$(x - h)^2 + (y - k)^2 = r^2$$

3. SUBSTITUTE THE KNOWN VALUES:

$$(x - (-5))^2 + (y - (-2))^2 = 2^2$$

4. SIMPLIFY THE EXPRESSION:

$$(x + 5)^2 + (y + 2)^2 = 4$$

THEREFORE, THE EQUATION OF THE CIRCLE IS:

$$(x + 5)^2 + (y + 2)^2 = 4$$

THIS IS THE PRECISE MATHEMATICAL DESCRIPTION OF THE CIRCLE WITH THE SPECIFIED CENTER AND RADIUS.

VISUALIZING THE CIRCLE

UNDERSTANDING THE GEOMETRY VISUALLY CAN REINFORCE COMPREHENSION.

PLOTTING THE CENTER AND RADIUS

- THE CENTER $(-5, -2)$ IS LOCATED 5 UNITS LEFT OF THE Y-AXIS AND 2 UNITS DOWN FROM THE X-AXIS.
- THE RADIUS OF 2 UNITS EXTENDS IN ALL DIRECTIONS FROM THE CENTER.

KEY POINTS ON THE CIRCLE

- LEFTMOST POINT: $(-5 - 2, -2) = (-7, -2)$
- RIGHTMOST POINT: $(-5 + 2, -2) = (-3, -2)$
- TOPMOST POINT: $(-5, -2 + 2) = (-5, 0)$
- BOTTOMMOST POINT: $(-5, -2 - 2) = (-5, -4)$

PLOTTING THESE POINTS ALONG WITH THE CENTER PROVIDES A CLEAR PICTURE OF THE CIRCLE'S SIZE AND POSITION.

APPLICATIONS OF THE CIRCLE EQUATION

UNDERSTANDING THE EQUATION OF A CIRCLE IS USEFUL IN VARIOUS FIELDS:

- GEOMETRY AND TRIGONOMETRY: SOLVING PROBLEMS INVOLVING DISTANCES AND ANGLES.
- COMPUTER GRAPHICS: DRAWING AND MANIPULATING CIRCULAR SHAPES.
- ENGINEERING: ANALYZING CIRCULAR COMPONENTS LIKE GEARS OR PIPELINES.
- NAVIGATION AND GPS: CALCULATING DISTANCES FROM A POINT TO A FIXED LOCATION.

ADDITIONAL CONCEPTS RELATED TO CIRCLES

TO DEEPEN YOUR UNDERSTANDING, HERE ARE SOME RELATED TOPICS:

1. THE GENERAL EQUATION OF A CIRCLE

BEYOND THE STANDARD FORM, THE GENERAL FORM IS:

PLAINTEXT

$$AX^2 + AY^2 + DX + EY + F = 0$$

PLAINTEXT

CONVERTING BETWEEN THE GENERAL AND STANDARD FORMS INVOLVES COMPLETING THE SQUARE.

2. THE DISTANCE FORMULA

THE EQUATION OF A CIRCLE CAN BE DERIVED FROM THE DISTANCE FORMULA:

PLAINTEXT

DISTANCE BETWEEN POINTS (X, Y) AND (H, K) :

PLAINTEXT

$$D = \sqrt{[(X - H)^2 + (Y - K)^2]}$$

PLAINTEXT

SINCE ALL POINTS (X, Y) ON THE CIRCLE ARE AT DISTANCE R FROM (H, K) , THE EQUATION FOLLOWS NATURALLY.

3. THE ROLE OF THE RADIUS

- THE RADIUS DETERMINES THE SIZE OF THE CIRCLE.
- INCREASING R RESULTS IN A LARGER CIRCLE.
- THE RADIUS IS ALWAYS A POSITIVE NUMBER; IF IT'S ZERO, THE CIRCLE DEGENERATES INTO A POINT.

REAL-WORLD EXAMPLES AND PRACTICE PROBLEMS

TO SOLIDIFY YOUR KNOWLEDGE, CONSIDER THE FOLLOWING EXAMPLES:

EXAMPLE 1: FIND THE EQUATION OF A CIRCLE WITH CENTER AT (3, 4) AND RADIUS 5.

SOLUTION:

$$(x - 3)^2 + (y - 4)^2 = 25$$

EXAMPLE 2: DETERMINE WHETHER THE POINT (-7, -2) LIES ON THE CIRCLE CENTERED AT (-5, -2) WITH RADIUS 2.

SOLUTION:

CALCULATE THE DISTANCE:

$$\text{DISTANCE} = \sqrt{(-7 + 5)^2 + (-2 + 2)^2} = \sqrt{(-2)^2 + 0^2} = \sqrt{4} = 2$$

SINCE THE DISTANCE EQUALS THE RADIUS 2, THE POINT (-7, -2) LIES ON THE CIRCLE.

CONCLUSION

IN SUMMARY, THE EQUATION OF A CIRCLE WITH CENTER AT (-5, -2) AND RADIUS 2 IS:

$$(x + 5)^2 + (y + 2)^2 = 4$$

THIS EQUATION SUCCINCTLY CAPTURES ALL POINTS LYING EXACTLY 2 UNITS FROM THE CENTER (-5, -2). MASTERY OF THE STANDARD FORM AND THE ABILITY TO MANIPULATE IT IS ESSENTIAL FOR SOLVING VARIOUS PROBLEMS IN GEOMETRY, ALGEBRA, AND APPLIED SCIENCES. WHETHER PLOTTING CIRCLES, ANALYZING GEOMETRIC CONFIGURATIONS, OR SOLVING REAL-WORLD PROBLEMS, UNDERSTANDING HOW TO DERIVE AND INTERPRET THE EQUATION OF A CIRCLE IS A VALUABLE SKILL IN MATHEMATICS.

FREQUENTLY ASKED QUESTIONS

WHAT IS THE STANDARD FORM EQUATION OF A CIRCLE WITH CENTER AT (-5, -2) AND RADIUS 2?

THE STANDARD FORM IS $(x + 5)^2 + (y + 2)^2 = 4$.

HOW DO YOU DERIVE THE EQUATION OF A CIRCLE GIVEN ITS CENTER AND RADIUS?

USE THE FORMULA $(x - h)^2 + (y - k)^2 = r^2$, WHERE (h, k) IS THE CENTER AND r IS THE RADIUS. FOR THE GIVEN CENTER (-5, -2) AND RADIUS 2, IT BECOMES $(x + 5)^2 + (y + 2)^2 = 4$.

WHAT IS THE RADIUS OF THE CIRCLE WITH CENTER AT $(-5, -2)$?

THE RADIUS IS 2 UNITS.

CAN YOU EXPLAIN THE SIGNIFICANCE OF THE VALUES IN THE CIRCLE'S EQUATION?

YES, $(h, k) = (-5, -2)$ INDICATES THE CENTER, AND THE VALUE ON THE RIGHT, 4, IS THE SQUARE OF THE RADIUS (r^2).

HOW WOULD YOU GRAPH THE CIRCLE WITH CENTER AT $(-5, -2)$ AND RADIUS 2?

PLOT THE CENTER AT $(-5, -2)$, THEN DRAW A CIRCLE WITH RADIUS 2 UNITS AROUND IT, ENSURING ALL POINTS ARE 2 UNITS AWAY FROM THE CENTER.

WHAT ARE SOME REAL-WORLD APPLICATIONS OF UNDERSTANDING THE EQUATION OF A CIRCLE?

APPLICATIONS INCLUDE DESIGNING CIRCULAR TRACKS, SATELLITE DISH ALIGNMENT, SENSOR RANGE MODELING, AND GRAPHICAL REPRESENTATIONS IN COMPUTER GRAPHICS.

ADDITIONAL RESOURCES

WHAT IS THE EQUATION OF A CIRCLE WHOSE CENTER AT $(-5, -2)$ AND RADIUS IS 2?

UNDERSTANDING THE EQUATION OF A CIRCLE IS FUNDAMENTAL IN COORDINATE GEOMETRY, WHETHER YOU'RE A STUDENT, TEACHER, OR ENTHUSIAST. WHEN GIVEN SPECIFIC PARAMETERS SUCH AS THE CENTER AND RADIUS, DERIVING THE EQUATION BECOMES A STRAIGHTFORWARD PROCESS BUT STILL OFFERS VALUABLE INSIGHTS INTO THE GEOMETRIC PROPERTIES OF CIRCLES. IN THIS GUIDE, WE'LL EXPLORE WHAT IS THE EQUATION OF A CIRCLE WHOSE CENTER AT $(-5, -2)$ AND RADIUS IS 2, BREAKING DOWN THE CONCEPT STEP-BY-STEP, AND PROVIDING PRACTICAL EXAMPLES TO SOLIDIFY YOUR UNDERSTANDING.

INTRODUCTION TO THE EQUATION OF A CIRCLE

BEFORE DIVING INTO THE SPECIFIC PROBLEM, LET'S REVIEW THE GENERAL FORM OF A CIRCLE'S EQUATION.

THE STANDARD EQUATION OF A CIRCLE

THE STANDARD FORM OF A CIRCLE'S EQUATION IN THE COORDINATE PLANE IS:

$$(x - h)^2 + (y - k)^2 = r^2$$

WHERE:

- (h, k) REPRESENTS THE CENTER OF THE CIRCLE.
- r IS THE RADIUS OF THE CIRCLE.

THIS FORM MAKES IT EASY TO IDENTIFY THE CIRCLE'S CENTER AND RADIUS DIRECTLY FROM THE EQUATION.

STEP-BY-STEP DERIVATION FOR THE GIVEN CIRCLE

GIVEN:

- CENTER AT $(-5, -2)$
- RADIUS $r = 2$

LET'S BREAK DOWN HOW TO FORMULATE THE EQUATION.

STEP 1: IDENTIFY THE CENTER COORDINATES

THE CENTER IS AT $(-5, -2)$, SO:

$$- h = -5$$

$$- k = -2$$

STEP 2: WRITE THE GENERAL EQUATION

PLUG THE CENTER COORDINATES AND RADIUS INTO THE STANDARD FORM:

$$(x - h)^2 + (y - k)^2 = r^2$$

BECOMES:

$$(x - (-5))^2 + (y - (-2))^2 = 2^2$$

STEP 3: SIMPLIFY THE EQUATION

SIMPLIFY DOUBLE NEGATIVES:

$$(x + 5)^2 + (y + 2)^2 = 4$$

THUS, THE EQUATION OF THE CIRCLE IS:

$$(x + 5)^2 + (y + 2)^2 = 4$$

GEOMETRIC INTERPRETATION

UNDERSTANDING THE IMPLICATIONS OF THIS EQUATION HELPS IN VISUALIZING THE CIRCLE:

- THE CENTER IS AT $(-5, -2)$.
- THE RADIUS IS 2, MEANING THE CIRCLE EXTENDS 2 UNITS IN ALL DIRECTIONS FROM THE CENTER.
- THE GRAPH OF THIS CIRCLE WILL BE CENTERED AT $(-5, -2)$, WITH POINTS ON THE CIRCLE SATISFYING THE EQUATION.

VISUALIZING THE CIRCLE

TO BETTER UNDERSTAND THE CIRCLE, CONSIDER:

PLOTTING THE CENTER

- MARK THE POINT $(-5, -2)$ ON THE COORDINATE PLANE.

DRAWING THE CIRCLE

- FROM THE CENTER, MEASURE 2 UNITS IN ALL DIRECTIONS:
 - UP TO $(-5, 0)$
 - DOWN TO $(-5, -4)$
 - LEFT TO $(-7, -2)$
 - RIGHT TO $(-3, -2)$
- THESE POINTS FORM THE BOUNDARY OF THE CIRCLE.

USING THE EQUATION FOR POINTS ON THE CIRCLE

ANY POINT (x, y) THAT SATISFIES:

$$(x + 5)^2 + (y + 2)^2 = 4$$

IS ON THE CIRCLE.

ADDITIONAL FORMS AND VARIATIONS

WHILE THE STANDARD FORM IS MOST STRAIGHTFORWARD, THERE ARE RELATED FORMS AND CONCEPTS:

GENERAL EQUATION OF A CIRCLE

IF AN EQUATION IS GIVEN IN THE EXPANDED FORM:

$$x^2 + y^2 + Dx + Ey + F = 0$$

IT CAN BE CONVERTED INTO STANDARD FORM BY COMPLETING THE SQUARE.

CONVERTING TO STANDARD FORM

SUPPOSE YOU ARE GIVEN A GENERAL FORM:

$$x^2 + y^2 + 10x + 4y + 13 = 0$$

TO FIND THE CENTER AND RADIUS:

1. GROUP X AND Y TERMS:

$$(x^2 + 10x) + (y^2 + 4y) = -13$$

2. COMPLETE THE SQUARE FOR EACH GROUP:

- FOR X: ADD AND SUBTRACT $(10/2)^2 = 25$

- FOR Y: ADD AND SUBTRACT $(4/2)^2 = 4$

3. REWRITE:

$$(x^2 + 10x + 25) + (y^2 + 4y + 4) = -13 + 25 + 4$$

$$(x + 5)^2 + (y + 2)^2 = 16$$

4. THE CENTER IS $(-5, -2)$, AND THE RADIUS IS $\sqrt{16} = 4$.

THIS METHOD IS ESSENTIAL WHEN WORKING WITH EQUATIONS NOT INITIALLY IN STANDARD FORM.

PRACTICAL APPLICATIONS

UNDERSTANDING HOW TO DERIVE AND INTERPRET THE EQUATION OF A CIRCLE HAS MANY USES:

- DESIGN AND ENGINEERING: DESIGNING CIRCULAR COMPONENTS OR PATHS.
- NAVIGATION: CALCULATING DISTANCES FROM A POINT TO A CIRCLE.
- COMPUTER GRAPHICS: RENDERING CIRCLES WITH SPECIFIC CENTERS AND RADII.
- PHYSICS: ANALYZING ORBITS AND CIRCULAR MOTION.

SUMMARY CHECKLIST

- IDENTIFY THE CENTER COORDINATES (H, K).
- USE THE STANDARD FORM: $(x - h)^2 + (y - k)^2 = r^2$.
- SUBSTITUTE THE GIVEN CENTER AND RADIUS INTO THE FORMULA.
- SIMPLIFY TO OBTAIN THE EQUATION.
- VISUALIZE THE CIRCLE BY PLOTTING THE CENTER AND RADIUS.

FINAL NOTES

THE EQUATION OF A CIRCLE IS A FUNDAMENTAL CONCEPT THAT PROVIDES A DIRECT LINK BETWEEN ALGEBRA AND GEOMETRY. FOR THE SPECIFIC CASE OF A CIRCLE WITH CENTER AT $(-5, -2)$ AND RADIUS 2, THE EQUATION:

$$(x + 5)^2 + (y + 2)^2 = 4$$

ENCAPSULATES ALL THE POINTS LYING ON THAT CIRCLE. MASTERING THIS PROCESS ENABLES YOU TO QUICKLY ANALYZE, GRAPH, AND MANIPULATE CIRCLES IN VARIOUS MATHEMATICAL AND REAL-WORLD CONTEXTS.

ADDITIONAL RESOURCES

- COORDINATE GEOMETRY TEXTBOOKS
- GRAPHING CALCULATORS AND SOFTWARE
- ONLINE GEOMETRY TOOLS
- PRACTICE PROBLEMS TO SOLIDIFY UNDERSTANDING.

BY UNDERSTANDING WHAT IS THE EQUATION OF A CIRCLE WHOSE CENTER AT $(-5, -2)$ AND RADIUS IS 2, YOU GAIN A POWERFUL TOOL FOR EXPLORING GEOMETRIC SHAPES, SOLVING PROBLEMS, AND APPRECIATING THE ELEGANCE OF MATHEMATICS IN DESCRIBING THE WORLD AROUND US.

What Is The Equation Of A Circle Whose Center At 5 2 And Radius Is 2

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