Equation of a circle, centre $(-g, -f)$

$$x^2 + y^2 + 2gx + 2fy + c = 0$$

Radius

Centre $\sqrt{g^2 + f^2 - c}$
$(-g, -f)$

$$R = \sqrt{g^2 + f^2 - c}$$

In solving problems on the circle, we can choose any of the general forms, depending on the information given.

Example 1

Given that $(x - 6)^2 + (y + 2)^2 = 45$ is the equation of a circle, state the coordinates of the centre and the radius.

Solution

The equation is of the form $(x - a)^2 + (y - b)^2 = r^2$ where (a, b) is the centre and r is the radius.
Hence, $a = 6$, $b = -2$, and $r = \sqrt{45}$

Example 2

A circle has an equation
$$x^2 + y^2 + 4x - 2y - 4 = 0$$
State the coordinates of the centre and the radius of the circle.

Solution

The general form of the equation is:
$$x^2 + y^2 + 2gx + 2fy + c = 0$$
The equation can be expressed as
$$x^2 + y^2 + 2(2)x + 2(-1)y + (-4) = 0.$$
Hence, $g = 2$ and $f = -1$.
The centre of this circle is $(-g, -f)$, so
$$(-(2), -(-1)) = (-2, 1)$$
and the radius , $r = \sqrt{(2)^2 + (-1)^2 - (-4)} = 3$ units.

Tangent and normal to a circle

We define the tangent and normal to a circle as follows:

The tangent to a circle at a point is the straight line that 'just touches' the circle at that point.

The normal to a circle at a point is the straight line that is perpendicular to the tangent at that point.
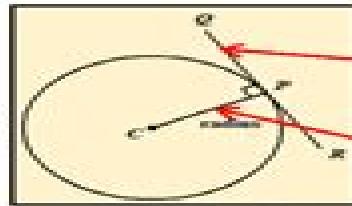
QR is the tangent to the circle at P.

CP is the normal to the circle at P.

The gradient of the tangent and normal to a circle

We recall that the angle made by the tangent to a circle and a radius, at the point of contact, is a right angle. Also, the product of the gradients of perpendicular lines is -1. Hence, if we obtain the gradient of either one of these lines, then we can deduce the gradient of the other.

To find the gradient of the tangent of a circle, centre, C at a given point, P, we calculate the gradient of the normal CP and then obtain the negative reciprocal of the gradient of CP.

Example 3

Find the gradient of the tangent of a circle at the point $A (4, 7)$ whose centre is the origin.

Solution

Centre
C
radius
A
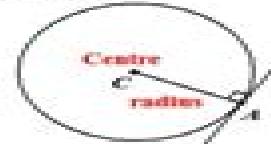
The gradient of the normal,
$AC = \frac{7 - 0}{4 - 0} = \frac{7}{4}$ where O is $(0, 0)$ and $A(4, 7)$.
Hence, the gradient of the tangent at
$$A = \frac{-1}{\text{Gradient of } AC}$$
$$= -\frac{4}{7}.$$

Circle Notes Geometry

William Allen Whitworth,Charles Taylor,James Whitbread Lee Glaisher

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The Quarterly Journal of Pure and Applied Mathematics ,1881 *Mathematics Explorations* David Spangler,2011 What are your chances of winning the lottery How much interest will you end up paying on that credit card purchase Thought provoking real world math problems and some humorous ones too require inductive and deductive reasoning as students search for a pattern break a code uncover and correct errors or use clues to solve a mystery Teacher pages set up full instructions for 27 activities driven by reproducible student handouts and correlated to NCTM standards A workbook containing all the handouts allows teachers to conveniently collect a students work Grades 6 9 Bibliography Answer keys with full solutions Good Year Books 199 pages Second Edition *Outer Circles* A. Marden,2007-05-31 We live in a three dimensional space what sort of space is it Can we build it from simple geometric objects The answers to such questions have been found in the last 30 years and Outer Circles describes the basic mathematics needed for those answers as well as making clear the grand design of the subject of hyperbolic manifolds as a whole The purpose of Outer Circles is to provide an account of the contemporary theory accessible to those with minimal formal background in topology hyperbolic geometry and complex analysis The text explains what is needed and provides the expertise to use the primary tools to arrive at a thorough understanding of the big picture This picture is further filled out by numerous exercises and expositions at the ends of the chapters and is complemented by a profusion of high quality illustrations There is an extensive bibliography for further study *Mathematical Questions and Solutions in Continuation of the Mathematical Columns of "the Educational Times"* ,1889 **Mathematical Questions and Solutions** ,1889 *The Journal of the Indian Mathematical Society* Indian Mathematical Society,1909 Vols for 1923 32 include separately paged sections Notes and questions and Progress report Beginning in 1933 Notes and questions is continued in the Mathematics student **The Messenger of Mathematics** ,1875 **Journal of Education** ,1914 *Mathematical Principles of the Internet, Volume 2* Nirdosh Bhatnagar,2018-11-21 This two volume set on Mathematical Principles of the Internet provides a comprehensive overview of the mathematical principles of Internet engineering The books do not aim to provide all of the mathematical foundations upon which the Internet is based Instead they cover a partial panorama and the key principles Volume 1 explores Internet engineering while the supporting mathematics is covered in Volume 2 The chapters on mathematics complement those on the engineering episodes and an effort has been made to make this work succinct yet self contained Elements of information theory algebraic coding theory cryptography Internet traffic dynamics and control of Internet congestion and queueing theory are discussed In addition stochastic networks graph theoretic algorithms application of game theory to the Internet Internet economics data mining and knowledge discovery and quantum computation communication and cryptography are also discussed In order to study the structure and function of the Internet only a basic knowledge of number theory abstract algebra matrices and determinants graph theory geometry analysis optimization theory probability theory and stochastic processes is required

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