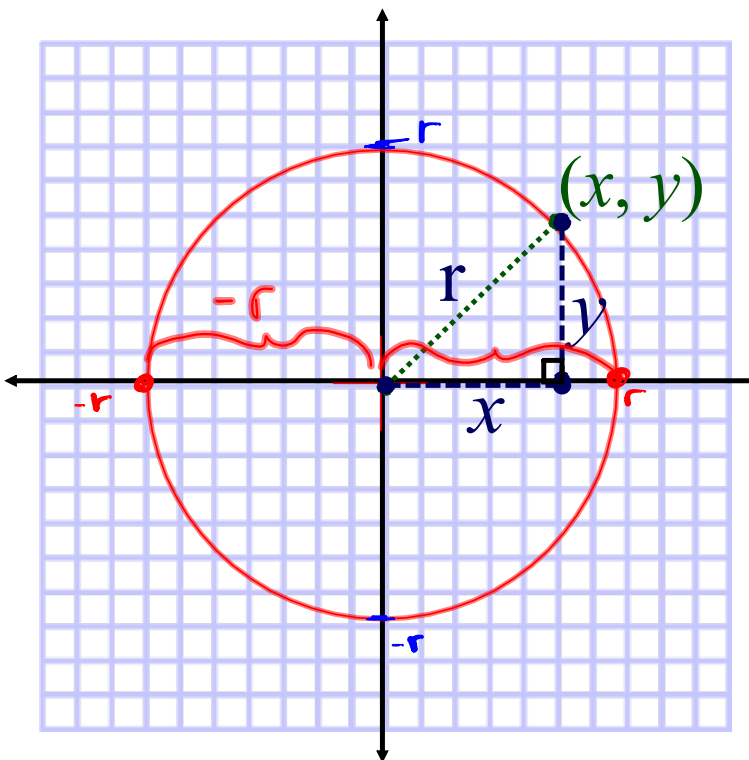


Circles with centre (0, 0)



Equation...

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

Domain... *Left to right*

$$\{-r \leq x \leq r, x \in R\}$$

Range... *Bottom to top*

$$\{-r \leq y \leq r, x \in R\}$$

x-intercepts... *(let y=0)*
(x,y)

$$(-r, 0) \text{ \& } (r, 0)$$

y-intercepts... *(let x=0)*
(x,y)

$$(0, -r) \text{ \& } (0, r)$$

$$(0, -r) \quad (0, r)$$

NOTE: The unit circle has its centre at (0, 0) and has a radius of 1.

Equation of a Circle

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

To determine the equation of a circle you need....

- 1) Centre of a circle
- 2) Radius

Examples...

Determine the equation of the circle with centre (0, 0) and ...

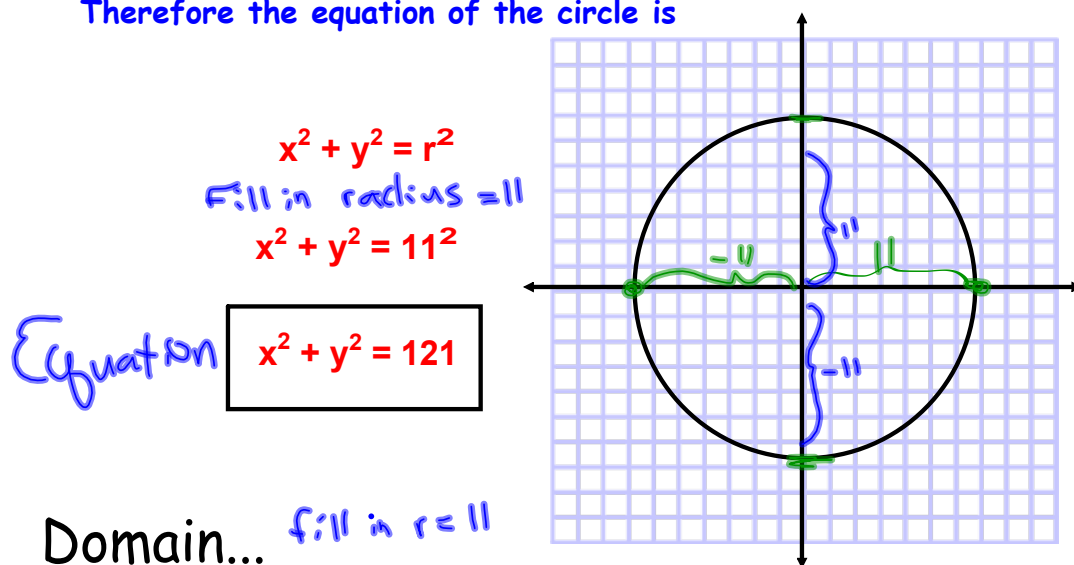
a) has a radius of 11

To find an equation we need a

1) Centre (0,0)

2) Radius (11)

Therefore the equation of the circle is



Domain... fill in $r=11$

$$\{-11 \leq x \leq 11, x \in \mathbb{R}\}$$

Range... fill in $r=11$

$$\{-11 \leq y \leq 11, y \in \mathbb{R}\}$$

x-intercepts...

$$(-11, 0) \text{ \& } (11, 0)$$

y-intercepts...

$$(0, -11) \text{ \& } (0, 11)$$

Examples...

Determine the equation of the circle with centre (0, 0) and ...

b) has a radius of $3\sqrt{7}$

To find an equation we need a

1) Centre (0,0)

2) Radius $3\sqrt{7}$

Therefore the equation of the circle is

$$\begin{aligned} x^2 + y^2 &= r^2 \\ \text{fill in } r &= 3\sqrt{7} \\ x^2 + y^2 &= (3\sqrt{7})^2 \end{aligned}$$

$$x^2 + y^2 = (3^2)(\sqrt{7}^2)$$

$$x^2 + y^2 = (9)(7)$$

Equation
★

$$x^2 + y^2 = 63$$

Recall

$$\begin{aligned} (\sqrt{a})^2 &= a \\ (a^{1/2})^2 &= a^1 \end{aligned}$$

Domain...

$$\{-3\sqrt{7} \leq x \leq 3\sqrt{7}, x \in R\}$$

Range...

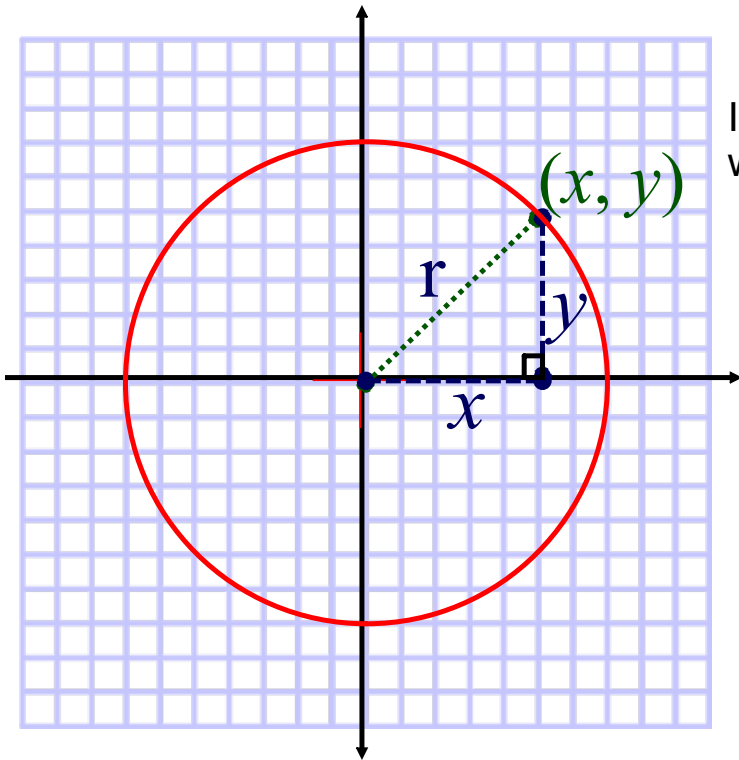
$$\{-3\sqrt{7} \leq y \leq 3\sqrt{7}, y \in R\}$$

x-intercepts...

$$(-3\sqrt{7}, 0) \text{ \& } (3\sqrt{7}, 0)$$

y-intercepts...

$$(0, -3\sqrt{7}) \text{ \& } (0, 3\sqrt{7})$$



If you need the radius you would need:

Need 2 points
Method 1) Distance Formula

$$r = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

(x_1, y_1) (x_2, y_2)

Method 2) Substitution

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

Examples...

Determine the equation of the circle with centre $(0, 0)$ and ...

c) passes through the point $(-8, -4)$

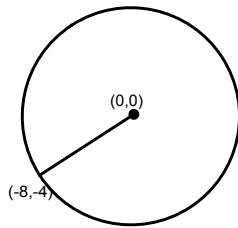
Method 1

To find an equation we need a

1) Centre $(0, 0)$

2) Radius

We need a radius



We could use the distance formula to find the length of the radius

$$\begin{matrix} x_1, y_1 & x_2, y_2 \\ (0, 0) & (-8, -4) \end{matrix}$$

$$\text{radius} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\text{radius} = \sqrt{(-8 - 0)^2 + (-4 - 0)^2}$$

$$\text{radius} = \sqrt{(-8)^2 + (-4)^2}$$

$$\text{radius} = \sqrt{64 + 16}$$

$$\text{radius} = \sqrt{80}$$

All we have left to do is plug it into the circle equations

$$\begin{aligned} x^2 + y^2 &= r^2 \\ x^2 + y^2 &= (\sqrt{80})^2 \\ \text{equation } x^2 + y^2 &= 80 \end{aligned}$$

$$r = \sqrt{80}$$

Domain...

$$\{-\sqrt{80} \leq x \leq \sqrt{80}, x \in \mathbb{R}\}$$

Range...

$$\{-\sqrt{80} \leq y \leq \sqrt{80}, y \in \mathbb{R}\}$$

x-intercepts...

$$(-\sqrt{80}, 0) \text{ \& } (\sqrt{80}, 0)$$

y-intercepts...

$$(0, -\sqrt{80}) \text{ \& } (0, \sqrt{80})$$

Examples...

Method 2: Substitution

Determine the equation of the circle with centre (0, 0) and ...

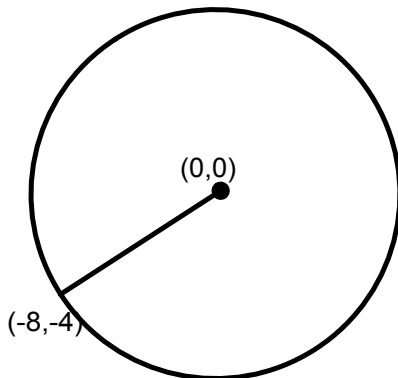
c) passes through the point $(-8, -4)$

To find an equation we need a

1) Centre (0,0)

2) Radius

We need a radius



We have a point that we know is on the circumference of the circle so you can plug the point in to get the radius

$$\begin{matrix} (-8, -4) \\ (x, y) \end{matrix}$$

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

$$(-8)^2 + (-4)^2 = r^2$$

$$64 + 16 = (r)^2$$

$$80 = r^2$$

$$\sqrt{80} = r$$

Now we just plug the radius into the circle equation:

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

Example 3 / Solution

Complete the following chart. *find radius*

<u>Equation</u> $x^2 + y^2 = (7)^2$	<u>Center</u>	<u>Domain</u>
$x^2 + y^2 = 49$ $x^2 + y^2 = r^2$	$(0,0)$	$\{x \mid -7 \leq x \leq 7, x \in \mathbb{R}\}$
<u>Range</u>	<u>x-intercepts</u>	<u>y-intercepts</u>
$\{y \mid -7 \leq y \leq 7, y \in \mathbb{R}\}$	and $(-7,0)$ $(7,0)$	and $(0,7)$ $(0,-7)$