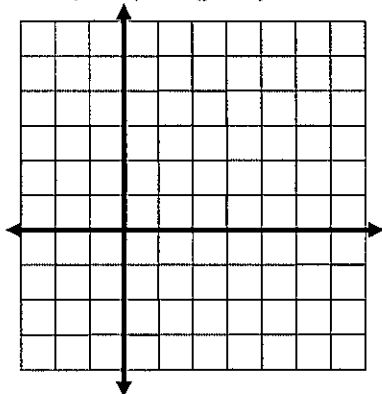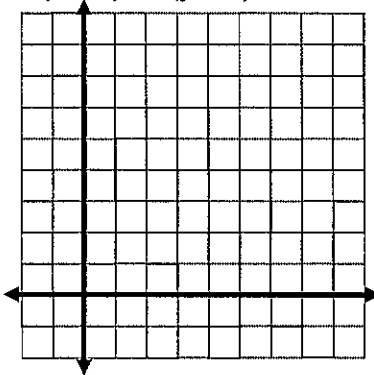## Equation of a Circle: $(x - h)^2 + (y - k)^2 = r^2$, Center = (h, k) and Radius = r

1) Graph the following circle:
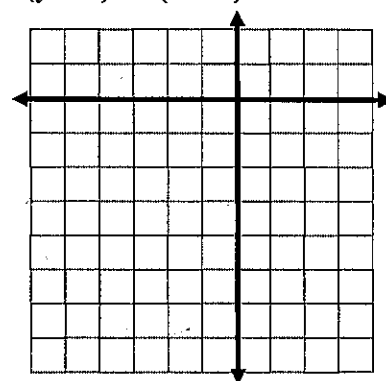
a. $(x - 1)^2 + (y - 3)^2 = 4$ **b.** $(x - 4)^2 + (y - 2)^2 = 9$ **c.** $(y + 3)^2 + (x + 2)^2 = 16$

2) For each circle: Identify its center and radius.

a. $(x + 2)^2 + (y - 5)^2 = 36$ b. $x^2 + (y - 9)^2 = 18$ c. $(y + 1)^2 + (x + 7)^2 = 24$

Center:_____   Center:_____   Center:_____

Radius:_____   Radius:_____   Radius:_____

3) Write the equation of the following circles:
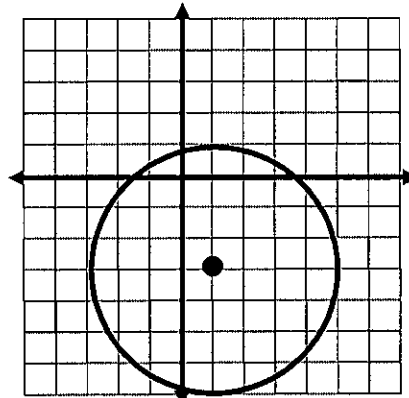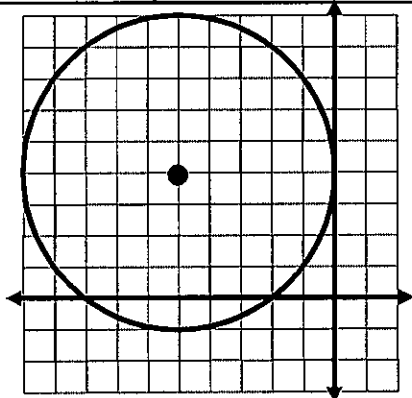
4) Give the equation of the circle that is tangent to the y-axis and center is (-3, 2).

5) Give the equation of the circle that is tangent to the x-axis and center is (5, -7).

Finding Circles in Standard Form: COMPLETE THE SQUARE on the x terms and y terms separately.

EXP: $x^2 + y^2 + 6x - 8y - 11 = 0$

$(x^2 + 6x) + (y^2 - 8y) = 11$ *x-terms: 6 ÷ 2 = 3 and (3)^2 = 9   y-terms: -8 ÷ 2 = -4 and (-4)^2 = 16*

$(x^2 + 6x + 9) + (y^2 - 8y + 16) = 11 + 9 + 16$ *Factor*

$(x + 3)^2 + (y - 4)^2 = 36$ Center: (-3, 4) Radius: 6

6) **Find the standard form, center, and radius of the following circles:**

6a) $x^2 + y^2 - 4x + 10y - 7 = 0$ 6b) $x^2 + 8x + y^2 + 5y - 2 = 0$

Center:_____ Radius:_____   Center:_____ Radius:_____

6c) $x^2 - 2x + y^2 + 12y + 18 = 0$ 6d) $x^2 - 10x + y^2 - 6y + 9 = 0$

Center:_____ Radius:_____   Center:_____ Radius:_____

7) **Give the equation of the circle whose**
a. Center is (4,-2) and goes through (2, 5)

9) **Give the equation of a circle whose**
a. Endpoints of a diameter at (-4, 1) and (4, -5)

b. Center is (3, 3) and goes through (1, 1)

b. Endpoints of a diameter at (7, -2) and (3, -8)

Equation of a Circle: $(x - h)^2 + (y - k)^2 = r^2$, Center = (h, k) and Radius = r

1) Graph the following circle:

a. $(x - 1)^2 + (y - 3)^2 = 4$

b. $(x - 4)^2 + (y - 2)^2 = 9$

c. $(y + 3)^2 + (x + 2)^2 = 16$

2) For each circle: Identify its center and radius.

a. $(x + 2)^2 + (y - 5)^2 = 36$

Center: $(-2, 5)$
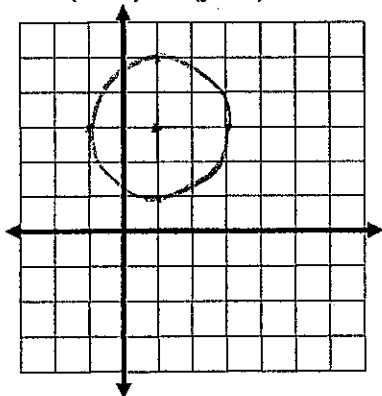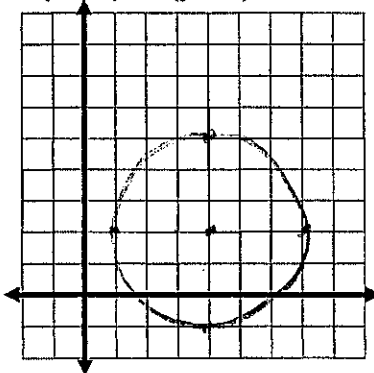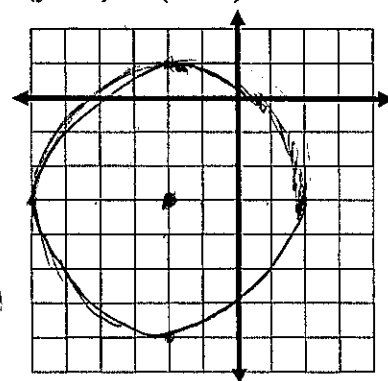
Radius: 6

b. $x^2 + (y - 9)^2 = 18$

Center: $(0, 9)$

Radius: $3\sqrt{2}$

c. $(y + 1)^2 + (x + 7)^2 = 24$

Center: $(-7, -1)$

Radius: $2\sqrt{6}$

3) Write the equation of the following circles:
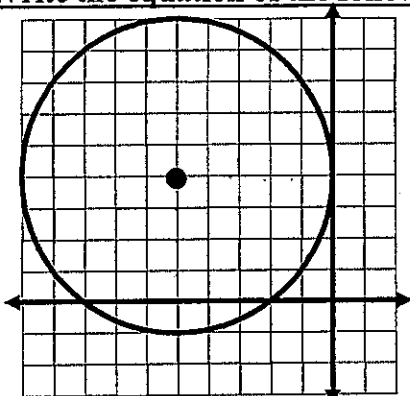
$C(-5, 4)$
$r = 5$

$(x+5)^2 + (y-4)^2 = 25$

$C(1, -3)$
$r = 4$

$(x-1)^2 + (y+3)^2 = 16$

4) Give the equation of the circle that is tangent to the y-axis and center is (-3, 2).

$(x + 3)^2 + (y - 2)^2 = 9$

5) Give the equation of the circle that is tangent to the x-axis and center is (5, -7).

$(x - 5)^2 + (y + 7)^2 = 49$

Finding Circles in Standard Form: COMPLETE THE SQUARE on the x terms and y terms separately.

EXP: $x^2 + y^2 + 6x - 8y - 11 = 0$

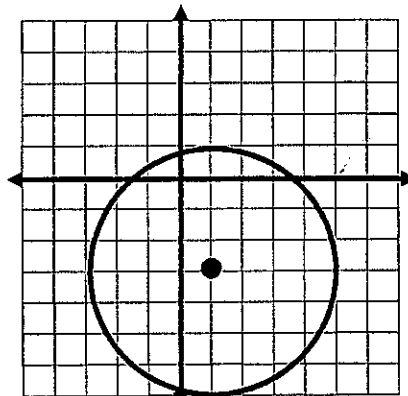$\quad\quad (x^2 + 6x) + (y^2 - 8y) = 11$ *x-terms: 6 ÷ 2 = 3 and (3)² = 9 y-terms: -8 ÷ 2 = -4 and (-4)² = 16*

$(x^2 + 6x + 9) + (y^2 - 8y + 16) = 11 + 9 + 16$ *Factor*

$\quad\quad (x + 3)^2 + (y - 4)^2 = 36$ $\quad\quad$ Center: (-3, 4) Radius: 6

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6) Find the standard form, center, and radius of the following circles:

6a) $x^2 + y^2 - 4x + 10y - 7 = 0$

$x^2 - 4x + \underline{4} + y^2 + 10y + \underline{25} = -7$
$\quad\quad\quad\quad\quad\quad\quad\quad + 4$
$\quad\quad\quad\quad\quad\quad\quad\quad + 25$

$(x - 2)^2 + (y + 5)^2 = 22$

Center: $(2, -5)$ Radius: $\sqrt{22}$

6b) $x^2 + 8x + y^2 + 5y - 2 = 0$

$x^2 + 8x + \underline{16} + y^2 + 5y + \underline{\tfrac{25}{4}} = 2$
$\quad\quad\quad\quad\quad\quad\quad\quad\quad + 16$
$\quad\quad\quad\quad\quad\quad\quad\quad\quad + \tfrac{25}{4}$

$(x + 4)^2 + \left(y + \tfrac{5}{2}\right)^2 = \tfrac{97}{4}$

Center: $\left(-4, -\tfrac{5}{2}\right)$ Radius: $\dfrac{\sqrt{97}}{2}$

6c) $x^2 - 2x + y^2 + 12y + 18 = 0$

$x^2 - 2x + \underline{1} + y^2 + 12y + \underline{36} = -18$
$\quad\quad\quad\quad\quad\quad\quad\quad + 1$
$\quad\quad\quad\quad\quad\quad\quad\quad + 36$

$(x - 1)^2 + (y + 6)^2 = 19$

Center: $(1, -6)$ Radius: $\sqrt{19}$

6d) $x^2 - 10x + y^2 - 6y + 9 = 0$

$x^2 - 10x + \underline{25} + y^2 - 6y + \underline{9} = -9$
$\quad\quad\quad\quad\quad\quad\quad\quad\quad + 25$
$\quad\quad\quad\quad\quad\quad\quad\quad\quad + 9$

$(x - 5)^2 + (y - 3)^2 = 25$

Center: $(5, 3)$ Radius: 5

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7) Give the equation of the circle whose
a. Center is (4,-2) and goes through (2, 5)

9) Give the equation of a circle whose
a. Endpoints of a diameter at (-4, 1) and (4, -5)

b. Center is (3, 3) and goes through (1, 1)

b. Endpoints of a diameter at (7, -2) and (3, -8)

7a. $(4, -2) \quad (2, 5)$

$\quad\quad h, k \quad\quad x \quad y$

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

$(2-4)^2 + (5-(-2))^2 = r^2$

$(-2)^2 + (7)^2 = r^2$

$\quad 4 + 49 = r^2$

$\quad\quad \sqrt{53} = \sqrt{r^2}$

$\quad\quad \sqrt{53} = r$

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

$(x-4)^2 + (y-(-2))^2 = (\sqrt{53})^2$

$\boxed{(x-4)^2 + (y+2)^2 = 53.}$

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b. $(3, 3) \quad (1, 1)$

$\quad\quad h \quad k \quad\quad x \quad y$

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

$(1-3)^2 + (1-3)^2 = r^2$

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

$\quad 4 + 4 = r^2$

$\quad\quad 8 = r^2$

$\quad\quad \sqrt{8} = r$

$\quad 2\sqrt{2} = r$

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

$(x-3)^2 + (y-3)^2 = (\sqrt{8})^2$

$\boxed{(x-3)^2 + (y-3)^2 = 8}$

9a. $(-4, 1)$ $(4, -5)$
      $x_1 y_1$ $x_2 y_2$

Use Mid point Formula
to find the center C.

$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

$M\left(\frac{-4+4}{2}, \frac{1+-5}{2}\right)$

$M(0, -2)$

$C(0, -2)$

— Use $C(0, -2)$ and $(-4, 1)$
in the circle equation
to find r.

$C(0, -2)$ $(-4, 1)$
  h k   x y

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

$(-4-0)^2 + (1-(-2))^2 = r^2$

$(-4)^2 + (1+2)^2 = r^2$

$(-4)^2 + (3)^2 = r^2$

  $16 + 9 = r^2$

    $25 = r^2$ $r = 5$

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

$(x-0)^2 + (y-(-2))^2 = 5^2$

$x^2 + (y+2)^2 = 25$

96. $(7, -2)$ $(3, -8)$

$\quad\quad x_1\ y_1 \quad\quad x_2\ y_2$

Midpoint Formula
to find center C.

$M\left(\dfrac{7+3}{2},\ \dfrac{-2+-8}{2}\right)$

$M\left(5, -5\right)$

$C\left(5, -5\right)$

$C(5, -5) \quad (7, -2)$

$\quad h\ k \quad\quad x\ y$

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

$(7-5)^2 + (-2-(-5))^2 = r^2$

$(2)^2 + (-2+5)^2 = r^2$

$(2)^2 + (3)^2 = r^2$

$4 + 9 = r^2$

$13 = r^2$

$\sqrt{13} = r$

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

$(x-5)^2 + (y-(-5))^2 = (\sqrt{13})^2$

$\boxed{(x-5)^2 + (y+5)^2 = 13}$