Find the center and radius of the following circles.

1. $x^2 + y^2 = 121$

$$C: (0,0)$$
$$r: \ 11$$

2. $(x-2)^2 + (y-5)^2 = 20$

$$C: (2,5)$$
$$r: \ 2\sqrt{5} \ \text{or} \ 4.47$$

3. $x^2 + y^2 + 2x - 8y - 83 = 0$

$(x^2 + 2x + 1) + (y^2 - 8y + 16) = 83$
$\qquad\qquad\qquad\qquad\quad +1$
$\qquad\qquad\qquad\qquad\quad +16$

$$(x+1)^2 + (y-4)^2 = 100$$
$$C: (-1,4) \quad r: 10$$

4. $x^2 + y^2 + 6y - 51 = 0$

$x^2 + (y^2 + 6y + 9) = 51 + 9$

$$x^2 + (y+3)^2 = 60$$
$$C: (0,-3) \quad r = 2\sqrt{15} \ \text{or} \ 7.75$$

5. Write the equation of the circle with center (-2, 3) and radius $3\sqrt{6}$.

$$(x+2)^2 + (y-3)^2 = (3\sqrt{6})^2$$
$$\boxed{(x+2)^2 + (y-3)^2 = 54}$$

6. Write the equation of the circle with center (1, -2) and passing through (-5, 7).

$\overset{h}{(-5-1)^2} + \overset{k}{(7- {}^-2)^2} = r^2 \quad (-6)^2 + (9)^2 = r^2 \quad 117 = r^2 \quad \overset{x\ y}{\boxed{(x-1)^2 + (y+2)^2 = 117}}$

Find the vertex, focus and directrix of the following parabolas.

7. $(x-2)^2 = -8(y+1)$ ↻↓ $p = 2$

Vertex $(2,-1)$
Focus $(2,-3)$ Directrix $y = 1$

8. $(y+1)^2 = 12(x-5)$

Vertex $(5,-1)$
Focus $(8,-1)$ Directrix $x = 2$

9. $y^2 - 6y + 4x + 17 = 0$

$y^2 - 6y + 9 = -4x - 17 + 9$
$(y-3)^2 = -4x - 8$
$(y-3)^2 = -4(x+2)$

Vertex $(-2,3)$
Focus $(-3,3)$ Directrix $x = -1$
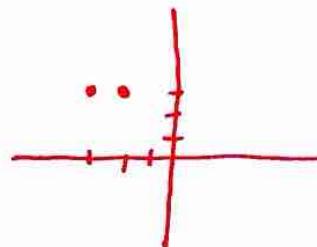
10. $x^2 - 20y + 40 = 0$

$x^2 = 20y - 40$
$x^2 = 20(y-2)$ $\qquad p = 5$
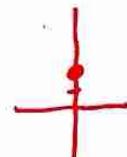
Vertex $(0,2)$
Focus $(0,7)$ Directrix $y = -3$

11. Write the equation of the parabola with vertex (4,2) and a focus (4,-4).

h K over (4,2)
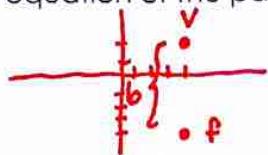
$(x-4)^2 = -4(6)(y-2)$

$\boxed{(x-4)^2 = -24(y-2)}$

12. Write the equation of the parabola with vertex (-1,1) and passing through (-4,3) opening to the left.

$(y-K)^2 = -4p(x-h)$ h k
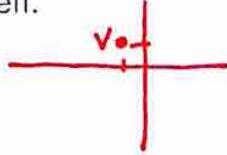
$(3-1)^2 = -4p(-4+1)$ $\frac{4}{12} = \frac{12p}{12}$ x y

$2^2 = -4p(-3)$ $\frac{1}{3} = P$

$\boxed{(y-1)^2 = -\frac{4}{3}(x+1)}$

Find the center, vertices and foci of the following ellipses.

13. $\dfrac{(x-3)^2}{16} + \dfrac{(y+1)^2}{25} = 1$

$a = 4$
$b = 5$

$c^2 = 25-16$
$c^2 = 9$
$c = 3$

(7,-1) (-1,-1)

Center (3,-1) Vertices (3,4) (3,-6)

Foci (3,2) (3,-4)

14. $\dfrac{x^2}{4} + \dfrac{y^2}{1} = 1$

$a = 2$
$b = 1$

$c = \pm\sqrt{3}$

(-2,0) (2,0)

Center (0,0) Vertices (0,1) (0,-1)

Foci ($\sqrt{3}$,0) (-$\sqrt{3}$,0)

15. $25x^2 + 9y^2 + 100x - 72y + 19 = 0$

$(25x^2 + 100x\quad) + (9y^2 - 72y\quad) = -19$

$25(x^2 + 4x + 4) + 9(y^2 - 8y + 16) = -19$
$+100$
144

$\dfrac{25(x+2)^2}{225\,9} + \dfrac{9(y-4)^2}{225\,25} = \dfrac{225}{225} 1$

$a=3$ $\boxed{\dfrac{(x+2)^2}{9} + \dfrac{(y-4)^2}{25} = 1}$
$b=5$

Center (-2,4) Vertices (-5,4)(1,4) (-2,9)(-2,-1)

Foci (-2,8) (-2,0)

$c^2 = 16$
$c = 4$

16. $16x^2 + 4y^2 - 32x - 40y + 52 = 0$

$(16x^2 - 32x\quad) + (4y^2 - 40y\quad) = -52$

$16(x^2 - 2x + 1) + 4(y^2 - 10y + 25) = -52$
$+16$
$+100$

$\dfrac{16(x-1)^2}{64\,4} + \dfrac{4(y-5)^2}{64\,16} = \dfrac{64}{64} 1$

$\dfrac{(x-1)^2}{4} + \dfrac{(y-5)^2}{16} = 1$ $a=2$
$b=4$

(3,5)(-1,5)

Center (1,5) Vertices (1,9)(1,-1)

Foci (1, 5±2$\sqrt{3}$) $c = 2\sqrt{3}$

17. Write the equation of the ellipse with vertices (-1,4), (1, -1), (-1, -6), and (-3, -1).

$\boxed{\dfrac{(x+1)^2}{4} + \dfrac{(y+1)^2}{25} = 1}$

Ctr (-1,-1)
$a = 2$
$b = 5$