

$$(1) x^2 + (y-3)^2 = 9$$

Circle

$$(2) \frac{(x-4)^2}{16} + \frac{(y-2)^2}{4} = 1$$

Ellipse

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

Parabola

$$8 = 4p$$

$$2 = p$$

$$V: (3, -4)$$

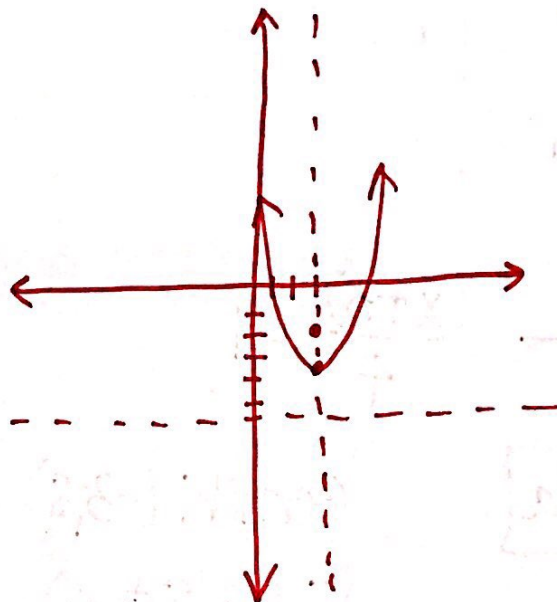
$$F: (3, -4+2)$$

$$(3, -2)$$

$$\text{Dir: } y = -4-2$$

$$y = -6$$

$$\text{AOS: } x = 3$$



$$(4) \frac{(y+2)^2}{18} - \frac{(x+1)^2}{25} = 1$$

Hyperbola

$$\text{Center: } (-1, -2)$$

$$V: (-1, -2 \pm 4.2)$$

$$(-1, 2.2) (-1, -6.2)$$

$$a^2 = 18$$

$$a = \pm 4.2$$

$$b^2 = 25$$

$$b = \pm 5$$

$$c^2 = 18 + 25$$

$$c^2 = 43$$

$$c = \pm 6.6$$

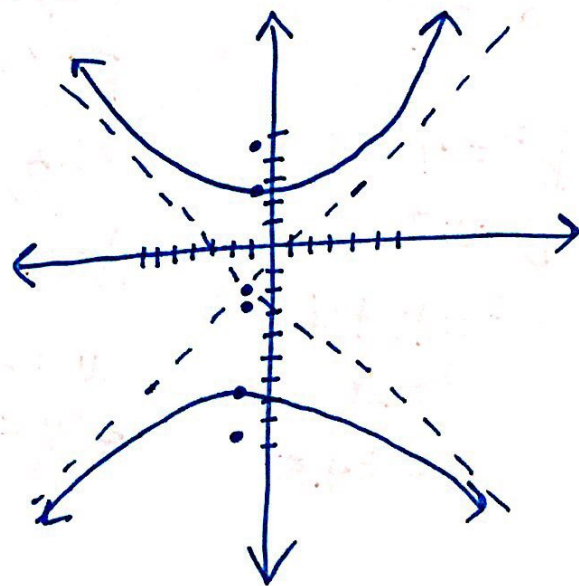
$$F: (-1, -2 \pm 6.6)$$

$$(-1, 4.6) (-1, -8.6)$$

$$\text{Asy: } y = \pm \frac{4.2}{5}(x+1) - 2$$

$$y = \frac{4.2}{5}x - 1.16$$

$$\# y = -\frac{4.2}{5}x - 2.84$$



$$\textcircled{5} \frac{(x+3)^2}{32} + \frac{(y-4)^2}{36} = 1$$

Ellipse

$$\textcircled{6} (x-5)^2 + (y+2)^2 = 28$$

Circle

$$\textcircled{7} (x-6)^2 + (y-2)^2 = 4$$

Circle

$$\textcircled{8} \frac{(y-8)^2}{16} - \frac{(x+3)^2}{4} = 1$$

Hyperbola

$$\text{Center: } (-3, 8)$$

$$V: (-3, 8 \pm 4)$$

$$(-3, 12) (-3, 4)$$

$$F: (-3, 8 \pm 4.5)$$

$$(-3, 12.5) (-3, 3.5)$$

$$\text{Asy: } y = \pm \frac{4}{2}(x+3) + 8$$

$$y = 2x + 14$$

$$\text{or } y = -2x + 2$$

$$a^2 = 16$$

$$a = \pm 4$$

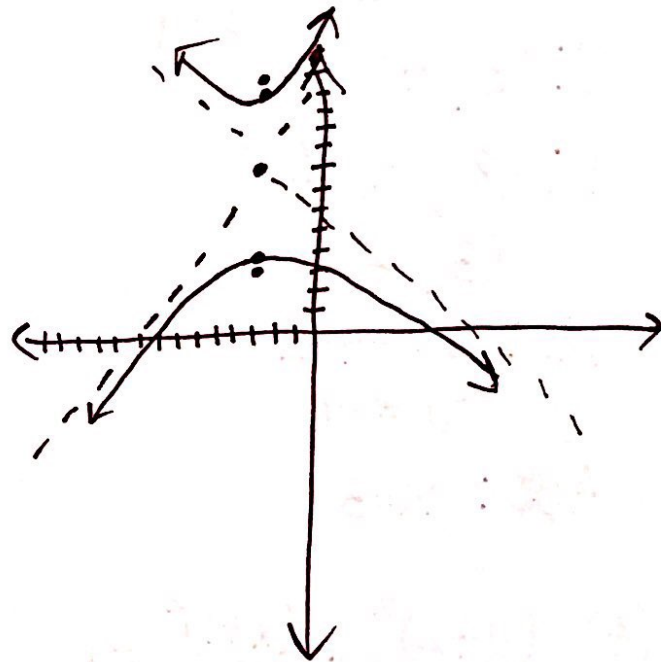
$$b^2 = 4$$

$$b = \pm 2$$

$$c^2 = 16 + 4$$

$$c^2 = 20$$

$$c = \pm 4.5$$



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

Parabola

$$4p = 3$$

$$p = 0.75$$

$$V: (-2, 4)$$

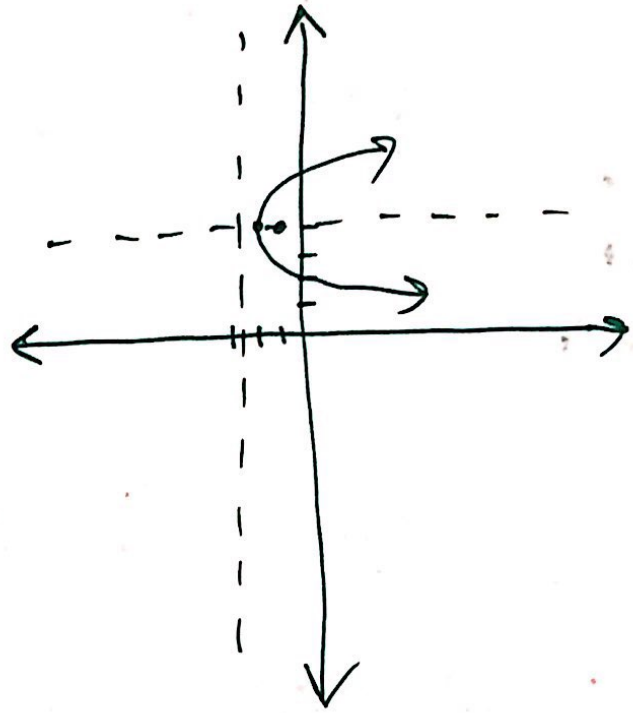
$$F: (-2+0.75, 4)$$

$$(-1.25, 4)$$

$$\text{Dir: } x = -2 - 0.75$$

$$x = -2.75$$

$$\text{AoS: } y = 4$$



$$(10) \frac{(x+1)^2}{16} + \frac{(y+3)^2}{4} = 1$$

Ellipse

$$(11) (x+7)^2 + (y-1)^2 = 1$$

Circle

$$(12) (x+7)^2 = 12(y-3)$$

Parabola

$$4p = 12$$

$$p = 3$$

$$V: (-7, 3)$$

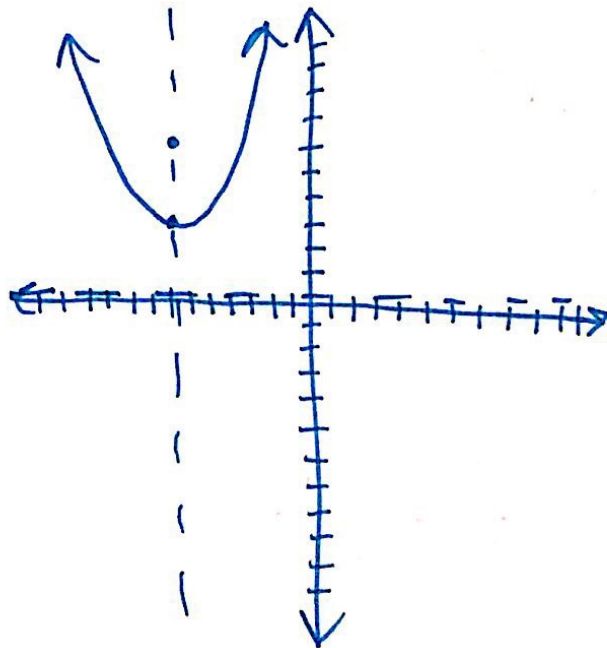
$$F: (-7, 3+3)$$

$$(-7, 6)$$

$$\text{Dir: } y = 3 - 3$$

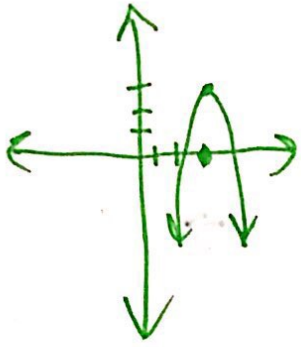
$$y = 0$$

$$\text{AoS: } x = -7$$



$$(14) V: (3, 3) \quad F: (3, 0)$$

$$p = 3$$



$$(x-3)^2 = 4p(y-3)$$

$$(x-3)^2 = -12(y-3)$$

$$(16) V: (2, 4) (8, 4) \quad F: (-2, 4) (12, 4)$$

$$\text{center: } \left(\frac{2+8}{2}, \frac{4+4}{2} \right) = (5, 4)$$

$$a = \frac{2-8}{2} = \frac{-6}{2} = -3 \quad a^2 = 9$$

$$c = \frac{-2-12}{2} = \frac{-14}{2} = -7 \quad c^2 = 49$$

$$c^2 = a^2 + b^2$$

$$49 = 9 + b^2$$

$$40 = b^2$$

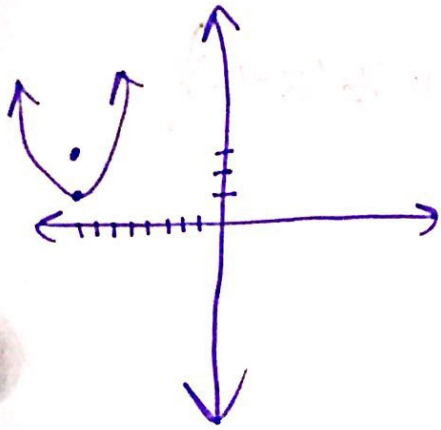
$$\frac{(x-5)^2}{9} - \frac{(y-4)^2}{40} = 1$$

$$(18) V: (-8, 1) \quad F: (-8, 3)$$

$$p = 2$$

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

$$(x+8)^2 = 4(y-1)$$



$$(20) V: (0, -2\sqrt{6}) \quad (0, 2\sqrt{6}) \quad F: (0, -5) \quad (0, 5)$$

$$\text{Center: } \left(\frac{0+0}{2}, \frac{-5+5}{2} \right) = (0, 0)$$

$$a = \frac{-2\sqrt{6} - 2\sqrt{6}}{2} = \frac{-4\sqrt{6}}{2} = -2\sqrt{6} \quad a^2 = 24$$

$$c = \frac{-5-5}{2} = \frac{-10}{2} = -5 \quad c^2 = 25$$

$$c^2 = a^2 + b^2$$

$$25 = 24 + b^2$$

$$1 = b^2$$

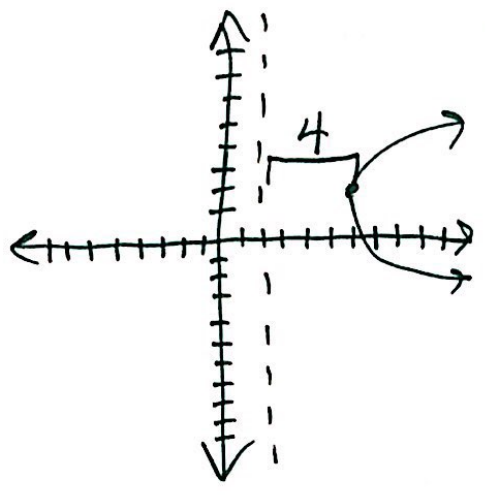
$$\frac{y^2}{24} - \frac{x^2}{1} = 1$$

② V: (6, 2) Dir. $x = 2$

$$(y-2)^2 = 4(4)(x-6)$$

$$(y-2)^2 = 16(x-6)$$

$p = 4$



③ $y^2 + 8x - 2y - 15 = 0$

V: (2, 1)

F: (2+2, 1)
(0, 1)

$$y^2 - 2y + 8x = 15$$

$4p = -8$

Dir: $x = 2 - 2$

$$(y^2 - 2y + 1) + 8x = 15 + 1$$

$p = -2$

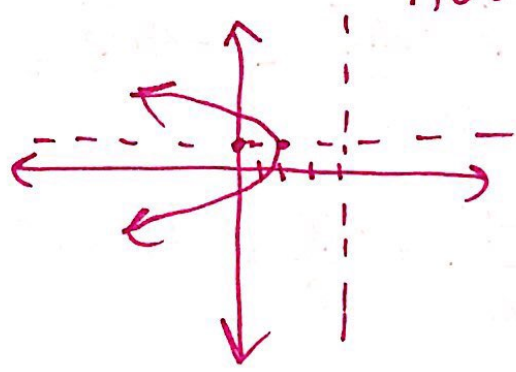
$x = 4$

$$(y-1)^2 + 8x = 16$$

Aos: $y = 1$

$$(y-1)^2 = -8x + 16$$

$$(y-1)^2 = -8(x-2)$$



④ $x^2 + y^2 - 12x + 2y + 15 = 0$

Circle

$$(37) \quad x^2 - 9y^2 + 54y - 90 = 0$$

$$x^2 - 9y^2 + 54y = 90$$

$$x^2 - 9(y^2 - 6y) = 90$$

$$x^2 - 9(y^2 - 6y + 9) = 90 - 81$$

$$\frac{x^2}{9} - \frac{9(y-3)^2}{9} = \frac{9}{9}$$

$$\frac{x^2}{9} - \frac{(y-3)^2}{1} = 1$$

Hyperbola

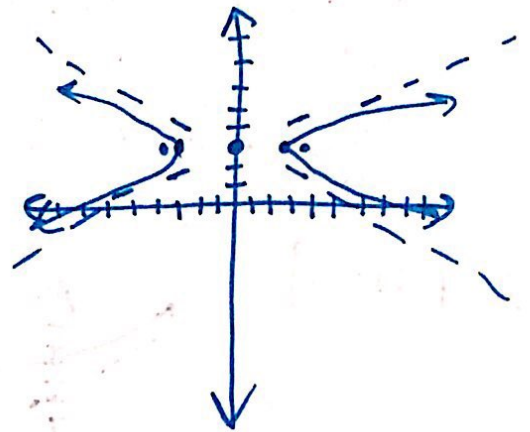
Center: (0, 3)

V: (3, 3) (-3, 3)

F: (3.2, 3) (-3.2, 3)

Asy: $y \pm \frac{1}{3}(x-0) + 3$

$$y = \pm \frac{1}{3}x + 3$$



$$(38) \quad 9x^2 + 36y^2 + 54x - 144y - 99 = 0$$

Ellipse

$$(39) \quad x^2 + 10x - 6y + 7 = 0$$

Parabola

$$x^2 + 10x - 6y = -7$$

$$(x^2 + 10x + 25) - 6y = -7 + 25$$

$$(x+5)^2 - 6y = 18$$

$$(x+5)^2 = 6y + 18$$

$$(x+5)^2 = 6(y+3)$$

$$4p = 6$$

$$p = 1.5$$

V: (-5, -3)

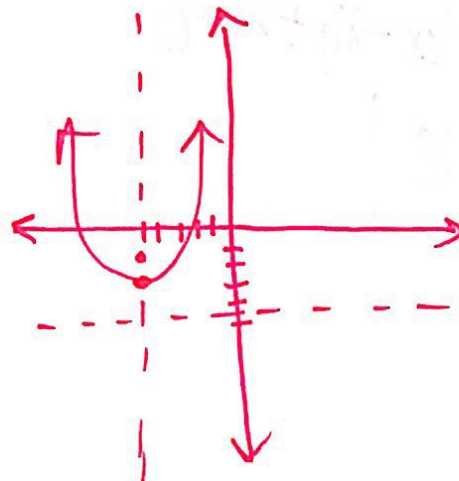
F: (-5, -3 + 1.5)

(-5, -1.5)

Dir: $y = -3 - 1.5$

$y = -4.5$

As: $x = -5$



$$(40) -2x^2 + 5y^2 + 24x - 20y - 102 = 0$$

$$-2x^2 + 24x + 5y^2 - 20y = 102$$

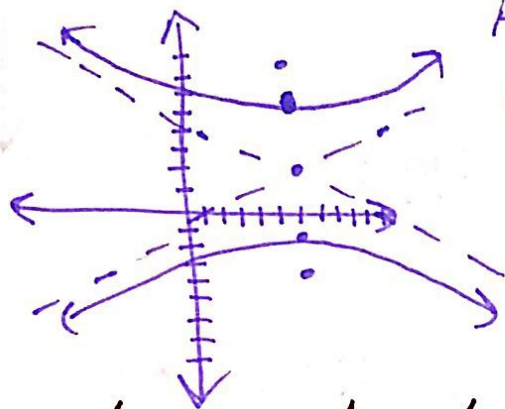
$$-2(x^2 - 12x + 36) + 5(y^2 - 4y + 4) = 102 - 72 + 20$$

$$-2 \frac{(x-6)^2}{50} + 5 \frac{(y-2)^2}{50} = \frac{50}{50}$$

$$-\frac{(x-6)^2}{25} + \frac{(y-2)^2}{10} = 1$$

$$\frac{(y-2)^2}{10} - \frac{(x-6)^2}{25} = 1$$

Hyperbola



$$a^2 = 10 \quad b^2 = 25$$

$$a = \pm 3.2 \quad b = \pm 5$$

$$c^2 = 10 + 25$$

$$c^2 = 35$$

$$c = \pm 5.9$$

Center: (6, 2)

V: (6, 2 ± 3.2)

(6, 5.2) (6, -1.2)

F: (6, 2 ± 5.9)

(6, 7.9) (6, -3.9)

Asy: $y = \pm \frac{10}{25}(x-6)$

$y = \frac{2}{5}x - 0.4$ and $y = -\frac{2}{5}x + 4.4$

$$(41) y^2 - 12y + 4x = -4$$

$$(y^2 - 12y + 36) + 4x = -4 + 36$$

$$(y-6)^2 + 4x = 32$$

$$(y-6)^2 = -4x + 32$$

$$(y-6)^2 = -4(x-8)$$

Parabola

$$4p = -4$$

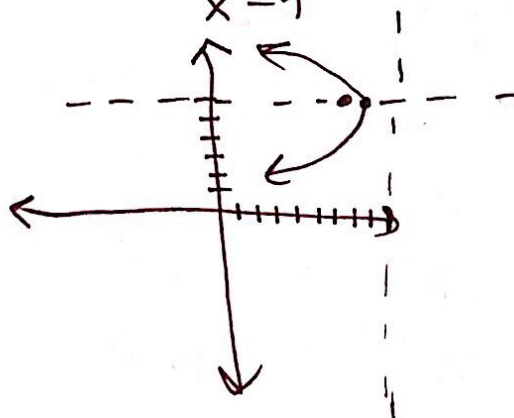
$$p = -1$$

V: (8, 6) F: (8-1, 6)

(7, 6)

Dir: $x = 8 - 1$ AOS: $y = 6$

$$x = 9$$



$$(42) x^2 + y^2 - 6x - 8y + 24 = 0$$

Circle

$$(43) \quad 9x^2 - y^2 - 72x + 8y + 119 = 0$$

$$9x^2 - 72x - y^2 + 8y = -119$$

$$9(x^2 - 8x + 16) - (y^2 - 8y + 16) = -119 + 144 - 16$$

$$\frac{9(x-4)^2}{9} - \frac{(y-4)^2}{9} = \frac{9}{9}$$

$$\frac{(x-4)^2}{1} - \frac{(y-4)^2}{9} = 1 \quad \boxed{\text{Hyperbola}}$$

Center: (4, 4)

V: (4 ± 1, 4) F: (4 ± 3.2, 4)
 (5, 4) (3, 4) (7.2, 4) (0.8, 4)

$$a^2 = 1 \quad b^2 = 9$$

$$a = \pm 1 \quad b = \pm 3$$

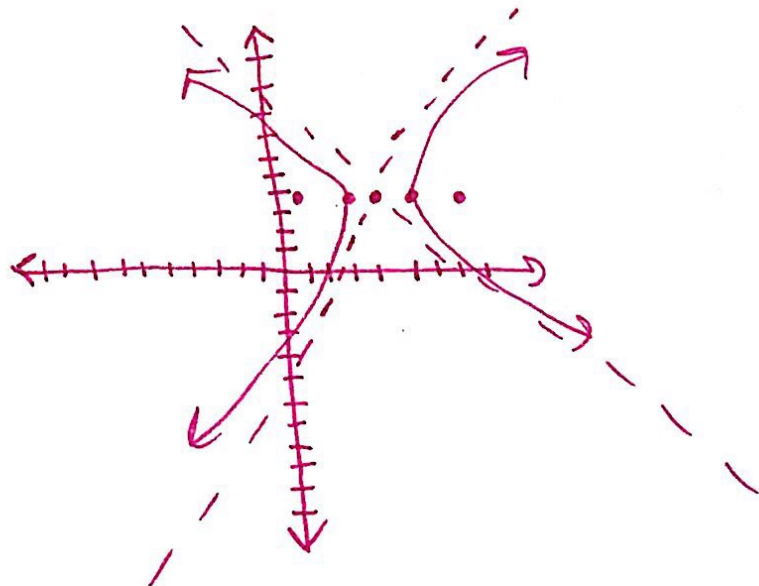
$$\text{Asy: } y = \pm \frac{3}{1}(x-4) + 4$$

$$y = 3x - 8 \quad \text{and} \quad y = -3x + 16$$

$$c^2 = 1 + 9$$

$$c^2 = 10$$

$$c = \pm 3.2$$



$$(44) \quad 4x^2 + y^2 - 48x - 4y + 48 = 0$$

$\boxed{\text{Ellipse}}$