Graph each conic section. Be sure to include any important features.

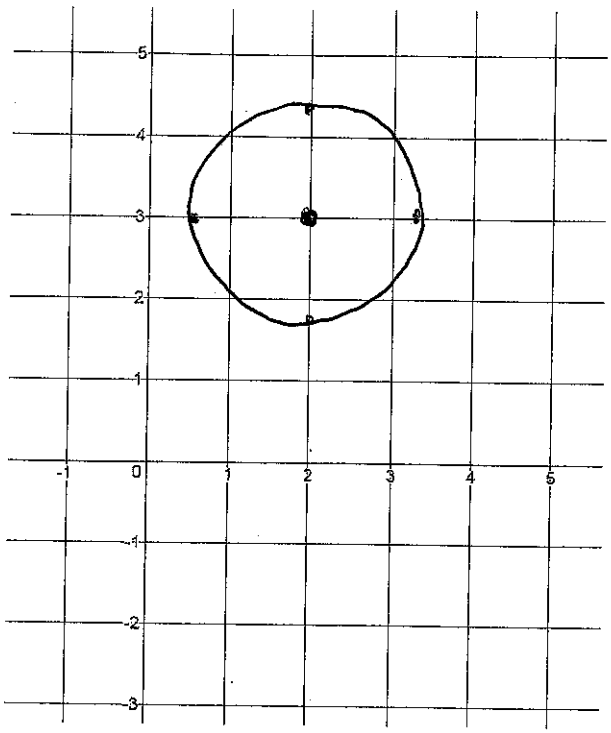
1. $x^2 + y^2 - 4x - 6y + 11 = 0$

$x^2 - 4x + 4 + y^2 - 6y + 9 = -11 + 4 + 9$

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

$C(2,3)$

$r = \sqrt{2} \approx 1.4$



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

$4x^2 + 32x + y^2 - 4y = -52$

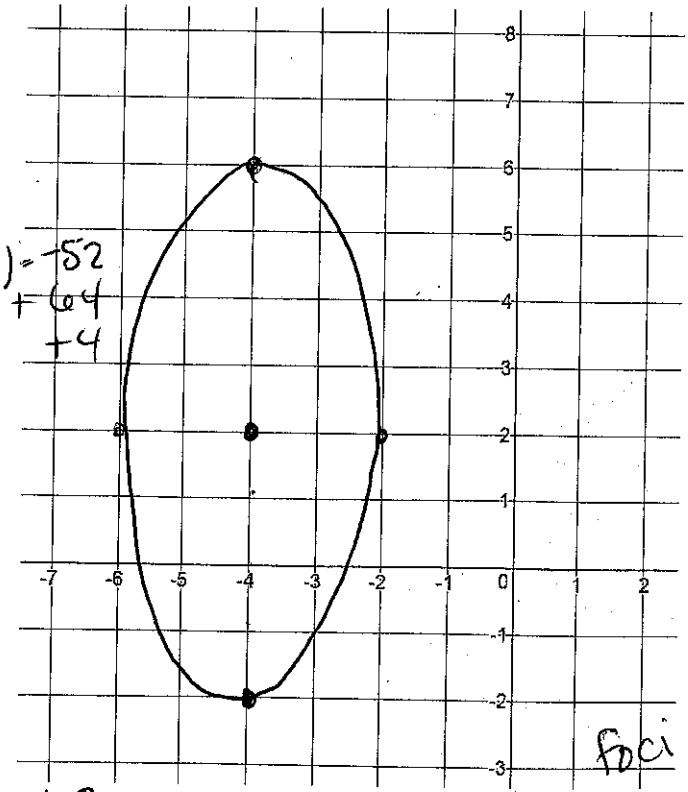
$4(x^2 + 8x + \underline{16}) + (y^2 - 4y + 4) = -52 + 64 + 4$

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

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

↘ vertical

$C(-4,2)$



foci

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

$16 = 4 + c^2$

$12 = c^2$

$c = 2\sqrt{3}$

$(-4, 2+2\sqrt{3})$

$(-4, 2-2\sqrt{3})$

3. $16x^2 + 96x - 4y^2 - 16y + 192 = 0$

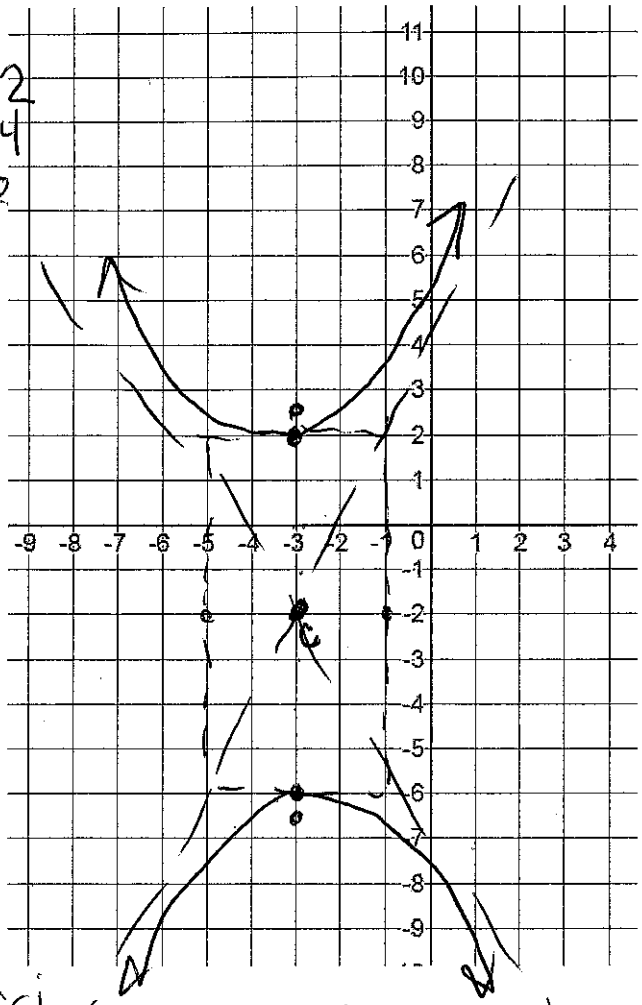
$16(x^2+6x+9) - 4(y^2+4y+4) = -192$
$144 \quad -16$

$\frac{16(x+3)^2}{-64} - \frac{4(y+2)^2}{-64} = \frac{-64}{-64}$

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

vertical ↑

$C(-3,-2)$



asymptotes $y = \pm\frac{4}{2}x$

$y = \pm 2x$

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

$16 + 4 = c^2$

$\sqrt{20} = \sqrt{c^2}$

$4.5 \approx 2\sqrt{5} = c$

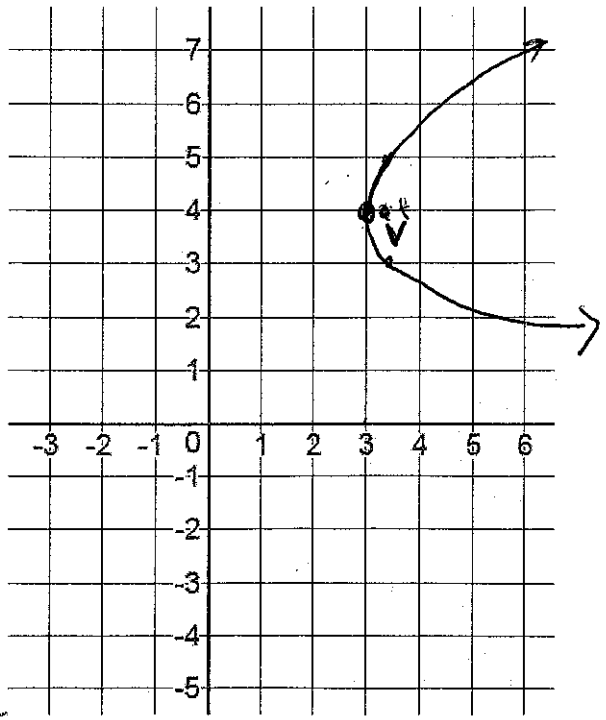
foci $(-3, -2+2\sqrt{5})$ $(-3, -2-2\sqrt{5})$

4. $y^2 - 8y - x + 19 = 0$

$y^2 - 8y + 16 + 19 = x$
$\quad\quad -16$

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

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



$V(3,4)$

$a = 1 \quad \frac{1}{1} = \frac{1}{4p}$

$p = \frac{1}{4} = .25$

$4p = 4(\frac{1}{4}) = 1$ focal chord