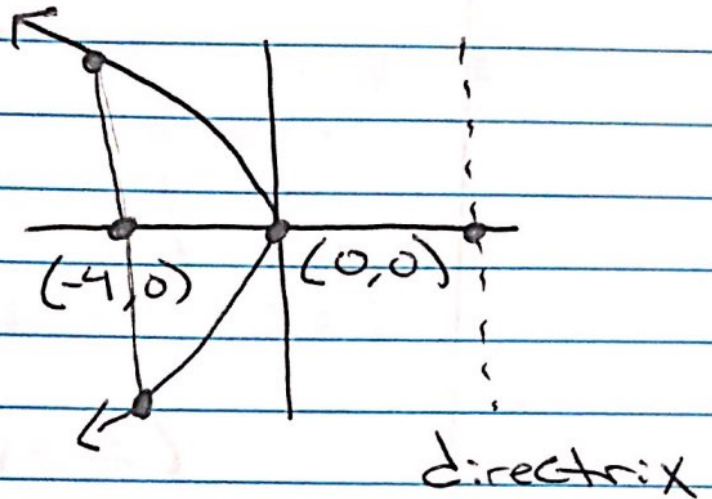


10.2 classwork

① Focus $(-4, 0)$, vertex $(0, 0)$

opens left



$$(y-k)^2 = 4a(x-h)$$

$$(y-0)^2 = 4a(x-0)$$

$$y^2 = 4a(x) \quad a = -4$$

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

$$\boxed{y^2 = -16x}$$

$$x = -4$$

latus rectum

$$y^2 = -16(-4)$$

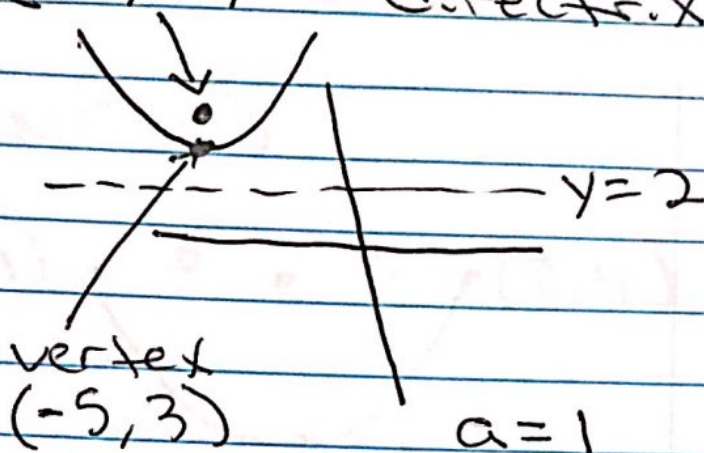
$$y^2 = 64$$

$$y = \pm\sqrt{64}$$

$$y = \pm 8$$

$$\boxed{(-4, 8), (-4, -8)}$$

② focus $(-5, 4)$ directrix: $y=2$



$$(x-h)^2 = 4a(y-k)$$

$$(x+5)^2 = 4(1)(y-3)$$

$$(x+5)^2 = 4(y-3)$$

$y=4$ latus
Rectum

$$(x+5)^2 = 4(4-3)$$

$$(x+5)^2 = 4$$

$$x+5 = \pm\sqrt{4}$$

$$x = -5 \pm 2$$

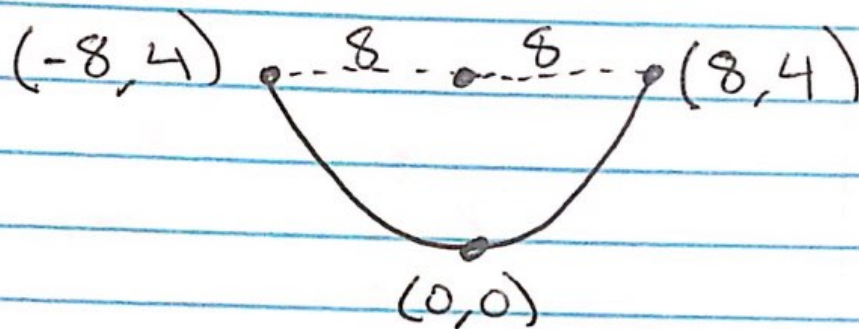
$$x = -3, -7$$

$$(-3, 4), (-7, 4)$$

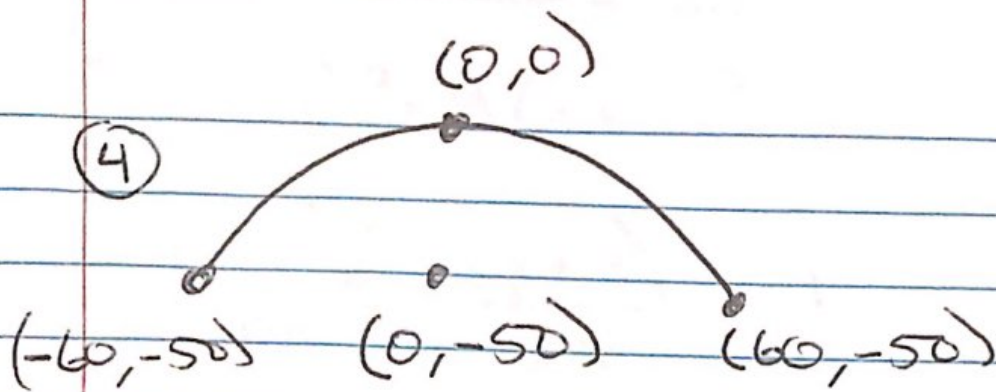
latus Rectum

③ diameter 16 inches , depth 4 inches

vertex $(0, 0)$



$$x^2 = 4ay$$
$$(8)^2 = 4(a)(4)$$
$$64 = 16a$$
$$\boxed{a = 4}$$



$$x^2 = 4ay$$

$$60^2 = 4a(-50)$$

$$a = -18$$

$$10 \rightarrow 10^2 = 4(-18)(y)$$

$$y = -1.39$$

$$50 - 1.39 = \boxed{48.61}$$

$$30 \rightarrow 30^2 = 4(-18)y$$

$$y = -12.5$$

$$50 - 12.5 = \boxed{37.50}$$

$$50 \rightarrow 50^2 = 4(-18)y$$

$$y = -34.72$$

$$50 - \del{34.72} = \boxed{15.28}$$

10.3 classwork

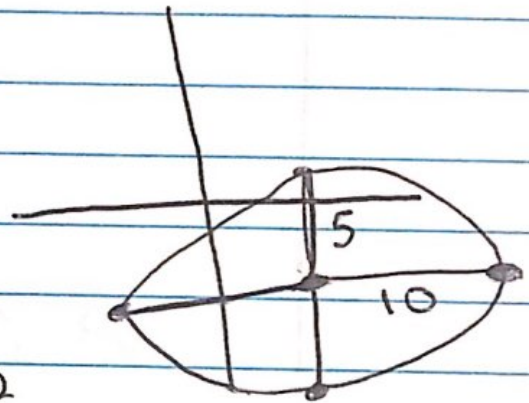
$$\textcircled{1} (x-4)^2 + 4(y+4)^2 = 100$$

$$\frac{(x-4)^2}{100} + \frac{(y+4)^2}{25} = 1$$

center $(4, -4)$

R vertex $(14, -4)$

L vertex $(-6, -4)$



R focus

$$(4 + 5\sqrt{3}, -4)$$

$$c^2 = a^2 - b^2$$

$$c^2 = 100 - 25$$

$$c = \pm 5\sqrt{3}$$

$$a = 10$$

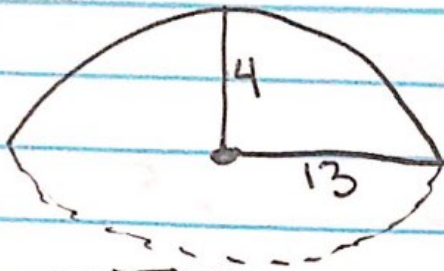
$$b = 5$$

L Focus

$$(4 - 5\sqrt{3}, -4)$$

Graph B

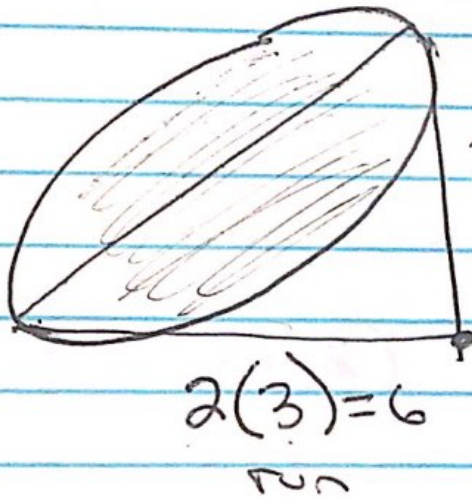
②



$$a = 13, a^2 = 169$$
$$b = 4, b^2 = 16$$

$$\frac{x^2}{169} + \frac{y^2}{16} = 1$$

③



$$2(2) = 4$$

rise

$$2(3) = 6$$

run

minor axis = diameter of pipe = $\boxed{6}$

major = $\sqrt{6^2 + 4^2} = \sqrt{52} = \boxed{7.21}$

$$\textcircled{4} \quad 9x^2 + y^2 + 6y = 0$$

$$9x^2 + y^2 + 6y + \boxed{9} = \boxed{9}$$

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

$$\frac{x^2}{1} + \frac{(y+3)^2}{9} = 1 \quad \begin{array}{l} a=3 \\ b=1 \end{array}$$

Center $(0, -3)$

$$c^2 = a^2 - b^2$$

$$c^2 = 9 - 1$$

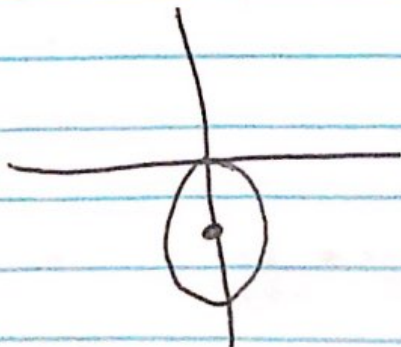
Foci $(0, -3 + 2\sqrt{2})$

$$c = \cancel{2\sqrt{2}} \pm \sqrt{8}$$

$(0, -3 - 2\sqrt{2})$

$$c = \pm 2\sqrt{2}$$

vertices $(0, 0), (0, -6)$



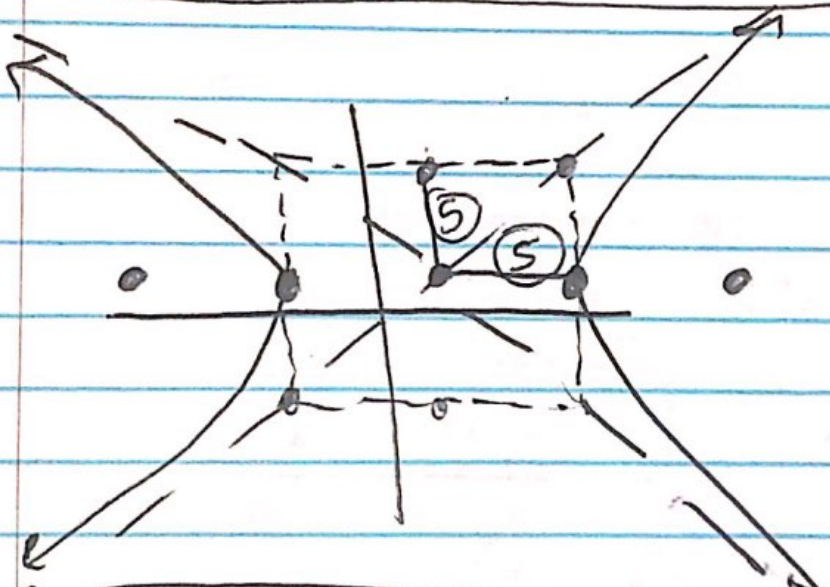
10.4 classwork

$$\textcircled{1} (x-2)^2 - (y-1)^2 = 25$$

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

center (2, 1)

transverse axis parallel to x-axis



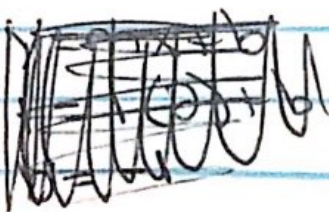
left vertex (-3, 1)

right vertex (7, 1)

left foci:
(2 - 5\sqrt{2}, 1)

$$\begin{aligned} c^2 &= a^2 + b^2 \\ c^2 &= 25 + 25 \\ c &= \pm 5\sqrt{2} \end{aligned}$$

right foci:
(2 + 5\sqrt{2}, 1)



~~original equation~~ $m = \pm 1$

$$(y-1) = \pm (x-2)$$

$$\textcircled{2} \quad 9y^2 - x^2 + 8x + 36y + 36 = 0$$

$$-x^2 + 8x + 9y^2 + 36y + 36 = 0$$

$$x^2 - 8x - 9y^2 - 36y - 36 = 0$$

$$x^2 - 8x + \boxed{16} - 9(y^2 + 4y + 4) = 0 + \boxed{16}$$

$$(x-4)^2 - 9(y+2)^2 = 16$$

$$\frac{(x-4)^2}{16} - \frac{(y+2)^2}{16/9} = 1$$

parallel to x-axis

Center (4, -2)

$$a = 4$$

$$b = 4/3$$

$$\frac{1}{\pm 3}$$

left vertex (0, -2)
right vertex (8, -2)

$$\text{slope} = \frac{4}{3} \cdot \frac{1}{4} = \frac{1}{3}$$

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

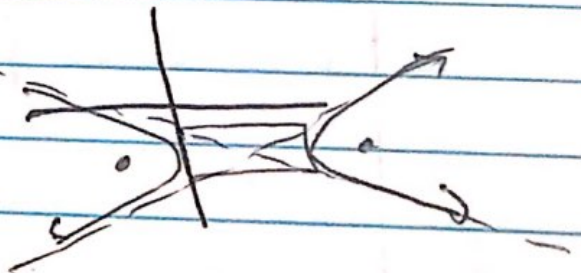
$$c^2 = 16 + \frac{16}{9}$$

focus left ~~(4, -2)~~ right focus
 $(4 - \frac{4\sqrt{10}}{3}, -2)$ $(4 + \frac{4\sqrt{10}}{3}, -2)$

$$c = \pm \sqrt{160/9}$$

$$c = \pm \frac{4\sqrt{10}}{3}$$

C



③ $x^2 = 8(y-2)$

parabola

B. Undefined parabola has vertex, not center

$4a = 8$

B. $a = 2$

D. vertex $(0, 2)$

B. Undefined no c

focus, $a = 2$ opens up

B. $(0, 2+2) = (0, 4)$ focus

directrix ~~$(2, 2)$~~

D. $2-2$ $y = 0$

C. no asymptotes

A. Graph



10.5 classwork

$$1) \quad 8y^2 - 5x^2 + 7x + 6 = 0$$

$$Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$$

-5 0 8 7 0 ~~6~~
6

$$B^2 - 4AC = 0 \quad \text{parabola}$$

$$B^2 - 4AC < 0 \quad \text{ellipse}$$

$$B^2 - 4AC > 0 \quad \text{hyperbola}$$

$$0^2 - 4(-5)(8)$$

$$160 > 0$$

hyperbola

$$\textcircled{2} 70x^2 - 120xy + 105y^2 - 24\sqrt{625}x - 18\sqrt{625}y = 0$$

$$\cot 2\theta = \frac{A-C}{B} = \frac{70-105}{-120} = \frac{7}{24} = \frac{x}{y}$$

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

$$7^2 + 24^2 = r^2 \quad r = 25$$

$$\cos 2\theta = \frac{7}{25}$$

$$\sin 2\theta = \frac{24}{25}$$

* half angle *

$$\cos \theta = \sqrt{\frac{1 + \cos 2\theta}{2}} = \sqrt{\frac{1 + \frac{7}{25}}{2}} = \frac{4}{5}$$

$$\sin \theta = \sqrt{\frac{1 - \cos 2\theta}{2}} = \sqrt{\frac{1 - \frac{7}{25}}{2}} = \frac{3}{5}$$

$$x = x' \cos \theta - y' \sin \theta \quad \left\{ \quad y = x' \sin \theta + y' \cos \theta \right.$$

~~scribbled out text~~

$$x = \frac{4}{5}x' - \frac{3}{5}y'$$

$$y = \frac{3}{5}x' + \frac{4}{5}y'$$

$$\textcircled{3} \quad 16x^2 + 24xy + 9y^2 - 150x + 70y = 0$$

* half angle *

$$\cot 2\theta = \frac{A-C}{B}$$

$$\cos \theta = \sqrt{\frac{1 + 7/25}{2}} = \frac{4}{5}$$

$$\cot 2\theta = \frac{16-9}{24} = \frac{7}{24}$$

$$\sin \theta = \sqrt{\frac{1 - 7/25}{2}} = \frac{3}{5}$$

$$\begin{aligned} * x^2 + y^2 &= r^2 * \\ r &= 25 \end{aligned}$$

$$\begin{aligned} x &= x' \cos \theta - y' \sin \theta \\ &= \frac{4}{5} x' - \frac{3}{5} y' \end{aligned}$$

$$\cos 2\theta = \frac{7}{25}$$

$$\cos^{-1}\left(\frac{7}{25}\right) = 2\theta$$

$$\boxed{x = \frac{1}{5}(4x' - 3y')}$$

$$\boxed{\theta = 36.9^\circ}$$

$$\begin{aligned} y &= x' \sin \theta + y' \cos \theta \\ &= \frac{3}{5} x' + \frac{4}{5} y' \end{aligned}$$

$$\boxed{y = \frac{1}{5}(3x' + 4y')}$$

over 

$$16x^2 = 16 \left(\frac{1}{5}\right)^2 (4x' - 3y')^2$$

$$\frac{256}{25} x'^2 - \frac{384}{25} x'y' + \frac{144}{25} y'^2$$

$$24xy = 24 \left(\frac{1}{5}\right) (4x' - 3y') \left(\frac{1}{5}\right) (3x' + 4y')$$

$$\frac{288}{25} x'^2 + \frac{168}{25} x'y' - \frac{288}{25} y'^2$$

$$9y^2 = 9 \left(\frac{1}{5}\right)^2 (3x' + 4y')^2$$

$$\frac{81}{25} x'^2 + \frac{216}{25} x'y' + \frac{144}{25} y'^2$$

$$-150x = -150 \left(\frac{1}{5}\right) (4x' - 3y')$$

$$-120x' + 90y'$$

$$70y = 70 \left(\frac{1}{5}\right) (3x' + 4y')$$

$$42x' + 56y'$$

Combine
~~25x'^2~~

$$25x'^2 - 78x' + 146y' = 0$$

Graph D

10.6 classwork

$$\textcircled{1} \quad r = \frac{32}{8+9\cos\theta} \quad \begin{array}{l} e > 1 \text{ hyperbola} \\ e = 1 \text{ parabola} \\ e < 1 \text{ ellipse} \end{array}$$

$$r = \frac{ep}{1+e\cos\theta}$$

divide everything by 8

$$r = \frac{4}{1+\frac{9}{8}\cos\theta} \quad e = \frac{9}{8} \quad \boxed{\text{hyperbola}}$$

$$ep = 4$$

$$\frac{9}{8}p = 4 \quad p = \frac{32}{9}$$

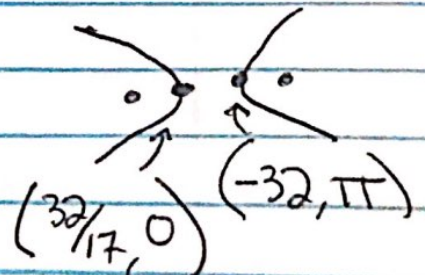
perpendicular to polar axis

directrix is $\frac{32}{9}$ units Right of pole

Transverse axis along polar axis

$$\theta = 0 \rightarrow \frac{32}{8+9(1)} = \boxed{\frac{32}{17}}$$

$$\theta = \pi \rightarrow \frac{32}{8+9(-1)} = \boxed{-32}$$



$$\ast e = \frac{c}{a} \ast$$

$$\textcircled{2} \quad r = \frac{28}{7-3\sin\theta}$$

$$r(7-3\sin\theta) = 28$$

$$7r - 3r\sin\theta = 28$$

$$7\sqrt{x^2+y^2} - 3y = 28$$

$$7\sqrt{x^2+y^2} = 3y + 28$$

$$49(x^2+y^2) = 9y^2 + 168y + 784$$

$$49x^2 + 49y^2 = 9y^2 + 168y + 784$$

$$49x^2 + 40y^2 - 168y = 784$$

~~49x^2 + 40y^2 - 168y = 784~~

$$49x^2 + 40y^2 - 168y - 784$$

$$(3) \quad r = \frac{21 \sec \theta}{7 \sec \theta + 1}$$

$$r(7 \sec \theta + 1) = 21 \sec \theta$$

$$\frac{r(7)}{\cos \theta} + r = \frac{21}{\cos \theta}$$

$$7r + r \cos \theta = 21$$

$$7(\sqrt{x^2 + y^2}) + x = 21$$

$$7(\sqrt{x^2 + y^2}) = 21 - x$$

$$49(x^2 + y^2) = 441 - 42x + x^2$$

$$49x^2 + 49y^2 = 441 - 42x + x^2$$

$$48x^2 + 49y^2 + 42x - 441 = 0$$

10.5 notes

$$Ax^2 + Cy^2 + Dx + Ey + F = 0$$

$AC = 0$ parabola

$AC > 0$ ellipse or circle

$AC < 0$ hyperbola

$$x = x' \cos \theta - y' \sin \theta$$

rotation

$$y = x' \sin \theta + y' \cos \theta$$

$$\cot(2\theta) = \frac{A - C}{B}$$

$$Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$$

$$Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$$

$$B^2 - 4AC = 0 \quad \text{parabola}$$

$$B^2 - 4AC < 0 \quad \text{ellipse or circle}$$

$$B^2 - 4AC > 0 \quad \text{hyperbola}$$

10.7 classwork

① $y = x^2 + 1$

a) $x = t$ $y = t^2 + 1$

b) $x = t^3$ $y = t^6 + 1$

② $\frac{x^2}{25} + \frac{y^2}{16} = 1$

$\frac{2\pi}{\omega} = \frac{2\pi}{6} = \frac{\pi}{3}$ moving
clockwise
so: $-\frac{\pi}{3}$

$x = \sqrt{25} \cos(-\frac{\pi}{3}t) = 5 \cos(-\frac{\pi}{3}t)$

$y = \sqrt{16} \sin(-\frac{\pi}{3}t) = 4 \sin(-\frac{\pi}{3}t)$

3) $X = 145 \cos 24^\circ t$
a) $y = -16t^2 + 145 \sin 24^\circ t + 6$

b) $y = 0$
 $-16t^2 + 145 \sin 24^\circ t + 6$

$A = -16$ $B = 145 \sin 24$ $C = 6$

$$X = \frac{-145 \sin 24 \pm \sqrt{(145 \sin 24)^2 - 4(-16)(6)}}{2(-16)}$$

$$\frac{-58.9768 \pm \sqrt{3478.2645 + 384}}{-32}$$

$$\frac{-58.9768 \pm 62.1471}{-32}$$

~~6.70718~~ $X = 3.79$

Negative solution omit

$$c) x = -b/2a = \frac{-145 \sin 24}{-32} = \boxed{1.84}$$

$$\textcircled{\text{d)}} -16(1.84)^2 + 145 \sin 24 (1.84) + 6 = \boxed{60.35}$$

$$d) \textcircled{\text{d)}} \textcircled{\text{d)}} 145 \cos 24 (3.79) = \boxed{502.04}$$

e) Graph C