

Find the standard form of the equation of the hyperbola with foci $(0, \pm 3)$ and asymptotes $y = \pm 2x$.

SCORE: ____ / 20 PTS

$$3^2 = a^2 + b^2$$

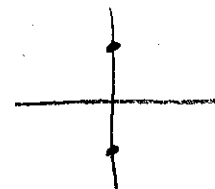
$$\frac{a}{b} = 2 \rightarrow a = 2b$$

$$9 = 4b^2 + b^2$$

$$b^2 = \frac{9}{5}$$

$$b = \frac{3}{\sqrt{5}} = \frac{3\sqrt{5}}{5} \rightarrow a = \frac{6\sqrt{5}}{5}$$

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



$$\frac{y^2}{\frac{36}{5}} - \frac{x^2}{\frac{9}{5}} = 1$$

Consider the polar equation $r = \frac{14}{3 - 4 \sin \theta}$.

SCORE: ____ / 30 PTS

[a] What is the shape of the graph of the equation?

$$r = \frac{14 \cdot \frac{1}{3}}{\frac{1}{3}(3 - 4 \sin \theta)} = \frac{\frac{14}{3}}{1 - \frac{4}{3} \sin \theta}$$

$$e = \frac{4}{3} \rightarrow \text{HYPERBOLA}$$

[b] Find the equation of the directrix.

$$ep = \frac{14}{3}$$

$$\frac{4}{3}p = \frac{14}{3}$$

$$p = \frac{7}{2}$$

$$y = -\frac{7}{2}$$

[c] Find the rectangular coordinates of all intercepts of the graph. NOTE: Do NOT convert the equation to rectangular form.

θ	r	
0	$\frac{14}{3}$	$(\frac{14}{3}, 0)$
$\frac{\pi}{2}$	-14	$(0, -14)$
π	$\frac{14}{3}$	$(-\frac{14}{3}, 0)$
$\frac{3\pi}{2}$	2	$(0, -2)$

[d] Find the rectangular coordinates of the center of the graph. NOTE: Do NOT convert the equation to rectangular form.

$$(0, \frac{-14 + -2}{2}) = (0, -8)$$

Write the eccentricity-based definition of a conic (from section 10.9).

SCORE: ____ / 7 PTS

A CONIC IS THE LOCUS OF POINTS IN THE PLANE WHOSE DISTANCES TO A FIXED POINT (FOCUS) AND A FIXED LINE (DIRECTRIX) HAVE A CONSTANT RATIO (ECCENTRICITY)

Chris's house is 2 miles from Hunter Street (which is a straight road). There is a road in Chris's town such that, no matter where you are on road, your distance from Hunter Street is half your distance from Chris' house. What is the shape of that road?

SCORE: ____ / 8 PTS



$$PQ = \frac{1}{2}PC$$

$$2 = \frac{PC}{PQ} = e \rightarrow \text{HYPERBOLA}$$

FILL IN THE BLANKS.

SCORE: ____ / 10 PTS

- [a] A/An ELLIPSE is the locus of points whose distances to two fixed points add up to a fixed constant.
- [b] The concept of ECCENTRICITY is used to measure the ovalness of an ellipse.
- [c] The line through the focus and vertex of a parabola is called the AXIS OF SYMMETRY.
- [d] The asymptotes of a hyperbola intersect at the CENTER of the hyperbola.

Consider the graph of the polar equation $r^3 = 1 + \cos 2\theta$.

SCORE: ____ / 20 PTS

- [a] Determine whether the graph is symmetric with respect to the pole, the polar axis, and $\theta = \frac{\pi}{2}$.

POLAR AXIS: $(r, -\theta)$ $r^3 = 1 + \cos 2(-\theta)$

$$r^3 = 1 + \cos(-2\theta)$$

$$r^3 = 1 + \cos 2\theta \text{ SYMMETRIC}$$

$\theta = \frac{\pi}{2}$: $(r, \pi - \theta)$ $r^3 = 1 + \cos 2(\pi - \theta) = 1 + \cos(2\pi - 2\theta)$

$$r^3 = 1 + \cos 2\pi \cos 2\theta + \sin 2\pi \sin 2\theta$$

$$r^3 = 1 + \cos 2\theta \text{ SYMMETRIC}$$

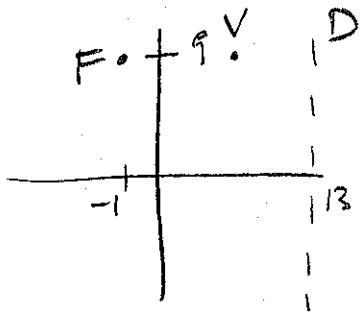
ALSO SYMMETRIC OVER POLE

- [b] What is the minimum interval for θ that you would need to plot points before using symmetry to finish drawing the graph?

$$\left[0, \frac{\pi}{2}\right]$$

Find the standard form of the equation of the parabola with focus $(-1, 9)$ and directrix $x = 13$.

SCORE: ____ / 15 PTS



$$\text{VERTEX} = \left(\frac{-1+13}{2}, 9 \right) = (6, 9)$$

$$p = -1 - 6 = -7$$

$$(y-9)^2 = 4(-7)(x-6)$$

$$(y-9)^2 = -28(x-6)$$

Convert the polar equation $r = \frac{3}{1-2\cos\theta}$ to rectangular form.

SCORE: ____ / 15 PTS

NOTE: You do NOT need to write your final answer in standard form, but any like terms must be simplified.

$$r - 2r\cos\theta = 3$$

$$r - 2x = 3$$

$$r = 2x + 3$$

$$r^2 = 4x^2 + 12x + 9$$

$$x^2 + y^2 = 4x^2 + 12x + 9$$

$$y^2 - 3x^2 - 12x - 9 = 0$$

Consider the conic with the equation $2x^2 + 3y^2 - 8x + 6y - 1 = 0$.

SCORE: ____ / 25 PTS

[a] Find the co-ordinates of the focus/foci.

$$2(x^2 - 4x + 4) + 3(y^2 + 2y + 1) = 1 + 8 + 3$$

$$2(x-2)^2 + 3(y+1)^2 = 12$$

$$\frac{(x-2)^2}{6} + \frac{(y+1)^2}{4} = 1$$

$$\text{CENTER} = (2, -1)$$

$$4 + c^2 = 6$$

$$c^2 = 2$$

$$c = \sqrt{2}$$

$$\text{FOCI} = (2 \pm \sqrt{2}, -1)$$

[b] If the conic is a circle, find the radius.
 If the conic is a parabola, find the equation of the directrix.
 If the conic is an ellipse, find the endpoints of the minor axis.
 If the conic is a hyperbola, find the equations of the asymptotes.

$$b^2 = 4$$

$$b = 2$$

ENDPOINTS OF MINOR AXIS

$$(2, -1 \pm 2) = (2, -3), (2, 1)$$