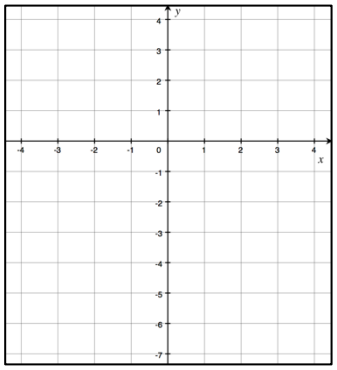
AP Precalculus – Exam 4.1 (Calculator) **Name** _____ **Pd.** _____

1. Sketch the curve described by the parametric equations:

$x = 1 - t \qquad y = 2t^2 - 3|t| - 5 \qquad -3 \le t \le 3$

t	–3	–2	–1	0	1	2	3
x							
y							



2. In the following exercises, eliminate the parameter and solve for y (except for d).

a) $x = 2t - 1 \qquad y = 2t + 1$

b) $x = t - 5 \qquad y = t^2 + t$

c) $x = t + 8 \qquad y = \dfrac{2t-1}{2t+3}$

d) $x = 2\cos t \qquad y = 3\sin t$

e) $x = 2e^{-2t}$ and $y = e^t$

f) $x = t^3$ and $y = 3\ln t$

3. For each rectangular equation, find a parametric equation by setting x equal to the given expression and finding the y-component.

a) $y = 3x^2 - 5x + 1, \quad x = t - 3$

b) $y = \dfrac{2x-5}{x^2 - x - 2}, \quad x = t + 2$

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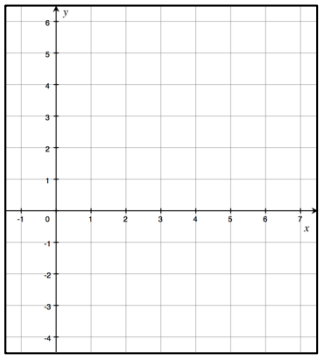
4. For the parametric function, $f(t)=\left(t^2-2t+1,t^2-4\right),-\infty<t<\infty$

a) find the maximum and minimum values of both *x* and *y* as well as the value of *t* where it occurs.
b) find the *x*- and *y*-intercepts as well as the value of *t* where it occurs.
c) find intervals when an object is moving left, right, up and down by completing the table.

$x(t)$: Max:	Min:
$y(t)$: Max:	Min:
$x-$ intercept : $t=$	Locations
$y-$ intercept : $t=$	Locations

Up to the right	Up to the left	Down to the right	Down to the left



5. A golfer hits a ball from an elevated tee 75 feet high at an initial velocity of 115 ft/sec at angle of elevation of 57º.

a) Write a parametric equation that describes the position of the ball at time *t*.

b) Approximately how long will it take for the ball to hit the ground?

c) Find the approximate maximum height of the ball (nearest integer).

d) The pin on the green is 150 yards away. Show that the ball will not reach the green.

e) The golfer compensates by swinging less hard (112 ft/sec) but using a club giving a lower angle of elevation. Use trial and error to find the angle of elevation (whole number) giving a perfect shot.

6. A deer hunter shoots an arrow from an initial height of 6 feet high. He is shooting over a level field. The arrow shoots off his bow at 144 mph at an angle of elevation of 5.5º.

a) Write a parametric equation that describes the position of the arrow at time *t*.

b) Find the approximate maximum height of the arrow (one decimal place).

c) Approximately how long will it take for the arrow to reach maximum height?

d) The deer is standing 300 feet from the archer and is 4 feet high. Will the arrow strike him? Explain.

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AP Precalculus – Exam 4.2 (No Calculator) **Name** _____ **Pd.** _____

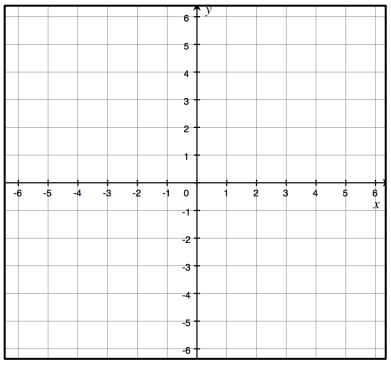
1. Find the equation of the circle in general form with diameter endpoints: (–2,8) and (–10,2)

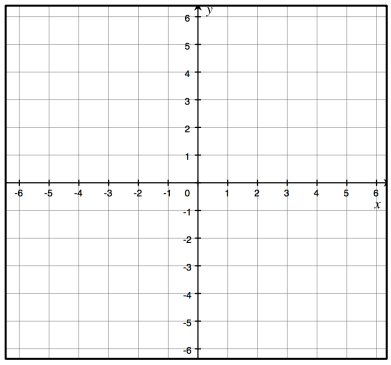
2. Find the center and radius of the following circle: $x^2 + y^2 - 8x + 20y + 77 = 0$

2. Sketch and find the equation of the parabola with the given vertex and focus. Sketch and find the equation of the directrix as well.

a) $V(0,0), F\left(0,\frac{3}{2}\right)$

b) $V(3,-1), F(-1,-1)$





3. Find the equation of the parabola with the given information.

a) Vertex (2, 3), directrix: $x = 3$

b) Vertex (–1,–3), opens up, (0,0) on curve

4. Find the vertex, focus, and directrix of the parabola: $y^2 - 10y + 12x + 49 = 0$ *(5 pts)*

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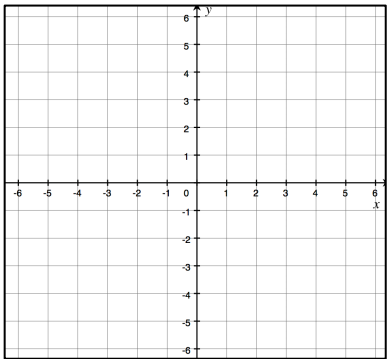
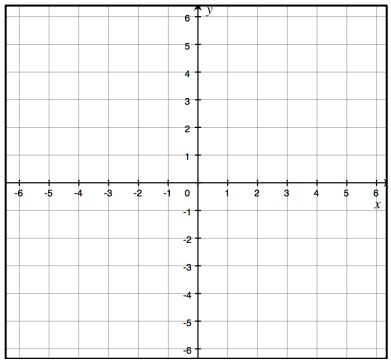
5. Find the center, vertices, foci, and eccentricity of the ellipse and sketch it.

a) $\left(x+1\right)^2+\dfrac{\left(y-3\right)^2}{4}=1$

b) $4x^2-24x+9y^2=0$





6. Find the equation of the ellipse with the given conditions.

a) Vertices (8,–4), (8,10),
Foci (8, 1), (8, 5)

b) Vertices (–2, –6), (–8, –6)
Eccentricity = 2/3

7. Find the equation of the hyperbola with the given conditions.

a) Vertices $\left(-1,\pm2\right)$, Foci $\left(-1,\pm6\right)$

b) Vertices $\left(3,5\right),\left(5,5\right)$, passing through (6,8)

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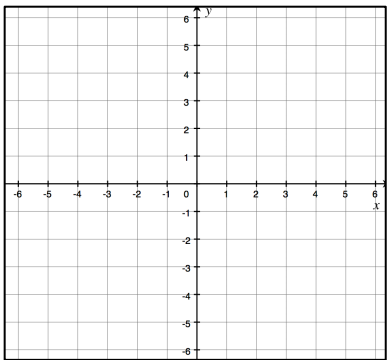
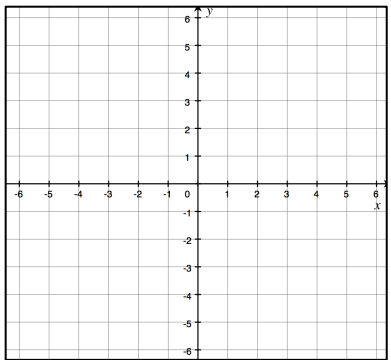
8. Find the center, vertices, foci, and eccentricity of the hyperbola and sketch it with its asymptotes.

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

b) $x^2-36y^2-2x-8=0$





9. Classify each graph. No work required.

a) $5x^2+2y^2-3x+6=0$

b) $2x^2-2y^2-7x-8y-4=0$

c). $3y^2-2x-3y+3=0$

d) $2x^2-3y^2+4x-6y=0$

e) $3x^2+2x+3y^2-8y-8=0$

f) $x^2+x+y^2-2y+10=0$

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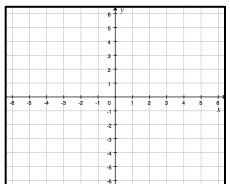
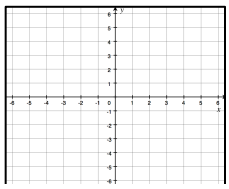
AP Precalculus – Quiz 4.3 (Calculator) **Name** _____ **Pd.** _____

1. Find and draw the vector **v** with initial point P and terminal point Q. Also find the magnitude of **v.**

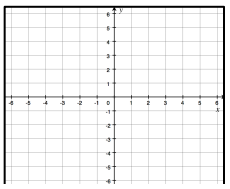
a) $P(-1,1), Q(3,-2)$



b). $P(0,-5), Q(-4,0)$



c) $P(-4,3), Q(-5,1)$



2. Show work to determine if the vector $\mathbf{v}$ with initial point (p_1, p_2) and terminal point (q_1, q_2) is equivalent to vector **w** with initial point (r_1, r_2) and terminal point (s_1, s_2)

a) $\mathbf{v}\ (5,3),(-2,2)$ $\mathbf{w}(7,-1),(0,-2)$

b) $\mathbf{v}\ (-10,-3),(-1,-12)$ $\mathbf{w}(7,-1),(-2,8)$

3. Given the vectors $\mathbf{u} = \langle -1,7 \rangle, \mathbf{v} = \langle 3,-1 \rangle$, find the following:

a) $\mathbf{u} + \mathbf{v}$

b) $\mathbf{u} - \mathbf{v}$

c) $4\mathbf{u} - 3\mathbf{v}$

d) $\mathbf{u} \cdot \mathbf{v}$

e) $\mathbf{u} \cdot \mathbf{v}^2$

f) the angle between **u** and **v** (2 dec)

4. Find a unit vector in the direction of the following vectors and show that it has length 1.

a) $\mathbf{v} = \langle 8,-15 \rangle$

b) $\mathbf{v} = \langle 3,0 \rangle$

c) $\mathbf{v} = \langle -4\sqrt{2}, -2 \rangle$

5. Let **u** be the vector with initial point (1, –8) and terminal point (–1, –5) and let $\mathbf{v} = 3\mathbf{i} - 4\mathbf{j}$. Write the following as a linear combination of **i** and **j**.

a) $\mathbf{u}$

b) $\mathbf{u} - 2\mathbf{v}$

c) $\dfrac{\mathbf{u}^2}{\|\mathbf{v}\|}$

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6. Write the vector **v** (algebraic) given its magnitude and the angle it makes with the positive x-axis. (*2 pts each*)

a) $\|\mathbf{v}\|=6 \quad \theta = 45°$ b) $\|\mathbf{v}\|=12 \quad \theta = 240°$ c) $\|\mathbf{v}\| = 10$ θ:direction of $6 - 2\mathbf{j}$

7. A painter is using a roller on a stick to paint a wall. If there is 50 pounds of pressure on the stick and if the stick is at an angle of $25°$ to the wall, how much force is being used to push the roller up the wall and how much force is being used against the wall? (*4 pts*)

8. Three tugboats are attempting to pull a barge due west. Boat one pulls the barge due west with a force of 50 tons. Boat two pulls the barge with 80 tons 18^o to the right of boat one while boat three pulls the barge with 65 tons 15^o to the left of boat one. How much force is on the barge and how many degrees to the right or left of west does it actually travel?

9. A plane travels on course $75°$ with airspeed 200 mph with a wind in the direction of $12°$ at 58 mph. What is the groundspeed and course of the plane?

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AP Precalculus – Quiz 4.4, 4.5 (No Calculator) **Name** _____ **Pd.** _____

1. If $\begin{bmatrix} 8x-3y \\ 6x+y \end{bmatrix} = \begin{bmatrix} 35 \\ 23 \end{bmatrix}$, find x and y

2. Solve for X: $2X - 3\begin{bmatrix} -1 & -5 \\ 3 & 0 \\ -3 & -6 \end{bmatrix} = 4\begin{bmatrix} -2 & 0 \\ 2 & 5 \\ -10 & 8 \end{bmatrix}$

3. If $A = \begin{bmatrix} -5 & -4 \\ -1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & 1 \\ 4 & -4 \end{bmatrix}$, find the following:

a) AB

b) $BA - AB$

4. Find $\begin{bmatrix} 3 & -1 & -8 \\ -1 & 2 & -4 \\ 7 & 1 & 3 \end{bmatrix}\begin{bmatrix} 2 & -4 \\ -2 & 6 \\ 0 & 3 \end{bmatrix}$

5. If $A = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$, describe A^n, n is an integer

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6. Solve for x and y:

a) $\begin{bmatrix} 2 & -3 \\ -6 & 5 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix}=\begin{bmatrix} -15 \\ 29 \end{bmatrix}$

b) $\begin{bmatrix} 5 & 2 & 0 \\ 3 & 0 & 4 \\ 0 & 1 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix}=\begin{bmatrix} 19 \\ -13 \\ 4 \end{bmatrix}$

7. Find the value of the determinant of the given matrix.

a) $\begin{bmatrix} 12 & -3 \\ 6 & -2 \end{bmatrix}$

b) $\begin{bmatrix} \sqrt{x} & x-y \\ y-x & \sqrt{y} \end{bmatrix}$

8. Find the following *(4 pts each)*

a) $\begin{bmatrix} 3 & -2 \\ -8 & 5 \end{bmatrix}^{-1}$

b) $\begin{bmatrix} 20 & -1 \\ 5 & 6 \end{bmatrix}^{-1}$

c) $\begin{bmatrix} \sqrt{a} & a-2 \\ 1 & \sqrt{a} \end{bmatrix}^{-1}$

9. Use the inverse matrix technique to solve the simultaneous equations: Show the matrices involved.

$5x+3y=24$
$8x+5y=38$

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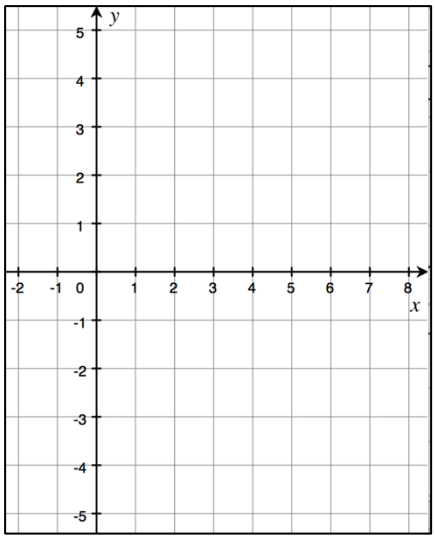
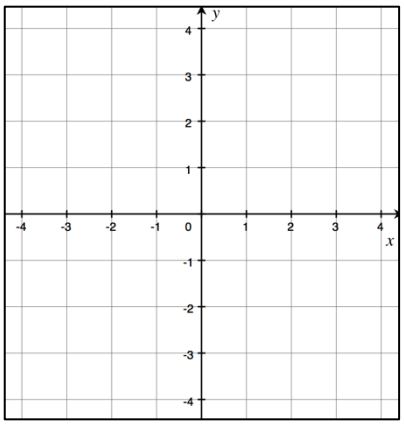
AP Precalculus – Quiz 4.6 (Calculator) **Name** _____ **Pd.** _____

1. Given the vectors shown, find its linear transformation using the given modification matrix M to create it and graph the result. Also find the magnitude of the dilation.



a) $A=\begin{bmatrix} 2 \\ -3 \end{bmatrix}, B=\begin{bmatrix} -1 \\ -4 \end{bmatrix}, M=\begin{bmatrix} 0.5 & -2 \\ 1 & -0.5 \end{bmatrix}$



b) $A=\begin{bmatrix} -3 \\ 2 \end{bmatrix}, B=\begin{bmatrix} 4 \\ 0 \end{bmatrix}, C=\begin{bmatrix} -1 \\ -2 \end{bmatrix}, M=\begin{bmatrix} 0.5 & 0.5 \\ 0.5 & -0.5 \end{bmatrix}$

2. $A=\begin{bmatrix} 6 \\ -5 \end{bmatrix}, B=\begin{bmatrix} -2 \\ -7 \end{bmatrix}, C=\begin{bmatrix} -3 \\ 3 \end{bmatrix}$ and $M_1=\begin{bmatrix} 5 & -8 \\ 2 & -3 \end{bmatrix}$ and $M_2=\begin{bmatrix} -3 & 0 \\ -1 & -2 \end{bmatrix}$.

a) Find the result of the two linear transformations, first M_1 and then M_2

b) The results in part a) can also be performed by first finding the product of which 2 matrices?

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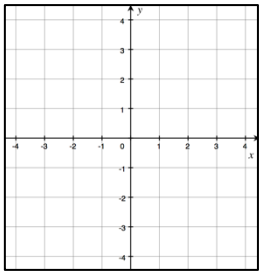
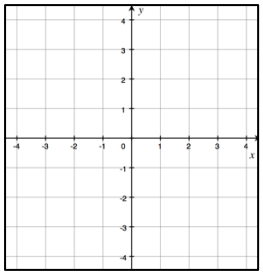
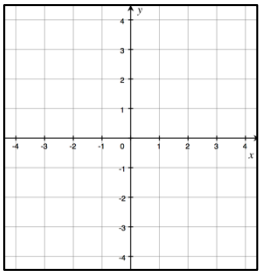
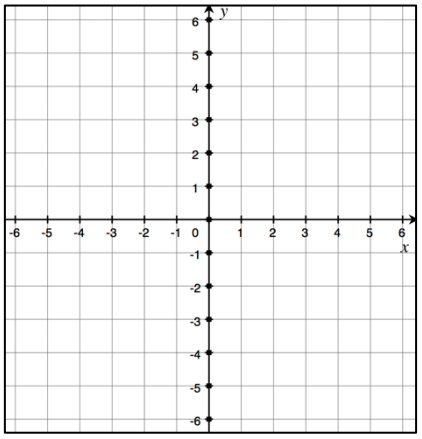
3. If vectors are linearly transformed by the following modification matrices, what is the resulting dilation and explain its meaning.

a) $\begin{bmatrix} 8 & -3 \\ 5 & -2 \end{bmatrix}$ b) $\begin{bmatrix} -5/3 & 15/4 \\ -4/3 & -9 \end{bmatrix}$ c) $\begin{bmatrix} -8/3 & -10/3 \\ 2 & 5/2 \end{bmatrix}$

4. Suppose $A=\begin{bmatrix} 2 \\ 3 \end{bmatrix}, B=\begin{bmatrix} -3 \\ 4 \end{bmatrix}, C=\begin{bmatrix} -2 \\ -2 \end{bmatrix}$, show the linear transformation for $\theta = 90°, 180°, 270°$.

5. Use $A=\begin{bmatrix} 2 \\ 1 \end{bmatrix}, B=\begin{bmatrix} 4 \\ -1 \end{bmatrix}, C=\begin{bmatrix} 1 \\ -2 \end{bmatrix}$. Using dilation $9/4$ and angle $\theta = 120°$, transform the figure created by the vectors and graph both figures on the given set of axes (1 decimal place) .



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AP Precalculus – Quiz 4.7 (Calculator) **Name** _____ **Pd.** _____

1. The transition matrix below gives the probability that during a given year, a person in a small town with one system of home heating will keep the same system or switch to another. Currently, 65% of the town's residents use oil, 13% use gas, 21% use electric, and 1% use solar.

		Next year's heating system			
		Oil	Gas	Electric	Solar
This year's heating system	Oil	0.745	0.222	0	0.033
	Gas	0.043	0.925	0.010	0.022
	Electric	0.045	0	0.855	0.100
	Solar	0	0	0.02	0.980

a) Create the initial state matrix S_0 and the transition probability matrix P.

b) Find the projected percentage of people using these heating systems in 1 year, 2 years, 5 years, and 10 years by completing the table. Show the formula you use. (3 dec. pl).

Year	Formula	Oil	Gas	Electric	Solar
1					
2					
5					
10					

c) Obviously extending this table out further makes little sense because of how technology changes. However, explain what happens to the percentage of people using solar heat over a long time. Explain why this would happen. (*1 pt*)

2. A No-Kill pet shelter charges various amounts of money to adopt a pet. If there is no history of such, every pet must have a rabies shot. The table to the right shows the number of pets adopted for five straight weeks and how many rabies shots were given. Determine the cost of adopting each type of pet as well as the cost of a rabies shot. Show the matrix operation you use to get your answer.

puppies	dogs	kittens	cats	rabies	receipts
8	6	6	5	10	$4,950
6	3	2	5	4	$3,165
10	8	4	4	20	$5,600
7	3	7	8	12	$4,595
5	8	10	7	15	$5,250

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AP Precalculus **Name** _____ **Pd.** _____
Unit 4 Comprehensive Exam Part 1 (Calculator)

1. A circle's equation is given by $4x^2+4y^2+24x-4y=3$. Find its center and radius.

A) $C\left(-3,\frac{1}{2}\right), r=\sqrt{3}$ B) $C\left(-3,\frac{1}{2}\right), r=\sqrt{10}$

C) $C(-6,4), r=\sqrt{3}$ D) $C(-6,4), r=\sqrt{10}$

2. A plane is traveling from Atlanta to San Francisco along heading $290°$ traveling with airspeed 400 mph. A wind of 35 mph is blowing in the direction $40°$. What is the approximate effect of the wind on the plane's groundspeed?

A) Reduce by 40 mph B) Reduce by 20 mph C) Reduce by 10 mph D) Increase by 5 mph

3. Find $\begin{bmatrix} 12 & -15 \\ 2 & -3 \end{bmatrix}^{-1}$

A) $\begin{bmatrix} -2 & 5/2 \\ -1/3 & 1/2 \end{bmatrix}$ B) $\begin{bmatrix} 1/2 & -5/2 \\ 1/3 & -2 \end{bmatrix}$ C) $\begin{bmatrix} 1/12 & -5/4 \\ 1/6 & -1/4 \end{bmatrix}$ D) $\begin{bmatrix} -1/2 & 5/2 \\ -1/3 & 2 \end{bmatrix}$

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4. The equivalent rectangular equation to $x = 1 + \cos^2\theta$ and $y = \frac{1}{2}\sin\theta$

A) $y = \pm\frac{\sqrt{2x - x^2}}{2}, x > 0$ B) $y = \pm\frac{\sqrt{2x - x^2}}{2}, x > 1$ C) $y = \pm\frac{\sqrt{2 - x}}{2}, x > 0$ D) $y = \pm\frac{\sqrt{2 - x}}{2}, x > 1$

5. Which of the following generates a hyperbola?

I. $4x^2 - 9y^2 = 0$ II. $4x^2 - 9y^2 = 2$ III. $4x^2 = 8 - 9y^2$

A) I only B) II only C) I and II only D) III only

6. Which of the following calculations could be used to solve a Markov chain problem?

I. $\begin{bmatrix} 0.6 & 0.4 \end{bmatrix}\begin{bmatrix} 0.2 & 0.8 \\ 0.7 & 0.3 \end{bmatrix}$ II. $\begin{bmatrix} 0.5 & 0.5 \end{bmatrix}\begin{bmatrix} 0.2 & 0.1 \\ 0.8 & 0.9 \end{bmatrix}$ III. $\begin{bmatrix} 0.25 & 0.75 \end{bmatrix}\begin{bmatrix} 0 & 1 \\ 0.5 & 0.5 \end{bmatrix}$

A) I only B) II only C) III only D) I and III onl

7. Ron Acuna hit a home run that left the bat (exit velocity) at 120 mph at an angle of elevation of $14°$. The next day, he hit the ball exactly with the exact same exit velocity but with an angle of elevation of $15°$. Approximately how much further does the ball travel? Assume that the ball is struck 3 feet off the ground.

A) 5 feet B) 10 feet C) 20 feet D) 30 feet

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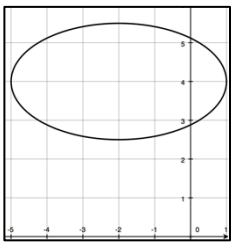
8. Find the focus of the parabola $y^2 - 6y + x + 17 = 0$

A) $(-8,-9)$ B) $(-8,-7)$ C) $\left(-8,\frac{-33}{4}\right)$ D) $\left(-8,\frac{-31}{4}\right)$

9. A particle moves along a curved path with velocity $\mathbf{v}(t) = 8\cos\left(\frac{t}{4}\right)\mathbf{i} - 4\sin\left(\frac{t}{4}\right)\mathbf{j}$. Find its speed at $t = \pi$.

A) 4 B) $2\sqrt{2}$ C) $2\sqrt{6}$ D) $2\sqrt{10}$

10. The figure to the right has which of the following equations?



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

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

11. If a particle moves along the parametric curve $f(t) = \left(\left|6 - t - t^2\right|, 2t + 4\right), -\infty < t < \infty,$ the particle will **never move** in which direction?

A) left B) right C) up D) down

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12. If $\mathbf{u} = \langle 5,-8 \rangle$ and $\mathbf{v} = \langle -3,4 \rangle$, find a unit vector in the direction of **u – v.**

A) $\langle 2,-3 \rangle$ B) $\left\langle \frac{2}{\sqrt{13}}, \frac{-3}{\sqrt{13}} \right\rangle$ C) $\left\langle \frac{1}{\sqrt{5}}, \frac{-2}{\sqrt{5}} \right\rangle$ D) $\left\langle \frac{2}{\sqrt{5}}, \frac{-1}{\sqrt{5}} \right\rangle$

13. Arrange the following equations from the greatest distance between a vertex and its closest focus to the smallest distance.

I. $\frac{y^2}{4} - \frac{x^2}{5} = 1$ II. $x^2 + \frac{y^2}{2} = 1$ III. $x^2 = 2y$

A) I, II, III B) I, III, II C) II, III, I D) III, II, I

14. If $\mathbf{u} = \left\langle \frac{4}{5}, -\frac{3}{4} \right\rangle$, how many of the following represent a vector orthogonal to **u**?

I. $\left\langle \frac{5}{4}, -\frac{4}{3} \right\rangle$ II. $\langle 15,16 \rangle$ III. $\langle -10,-12 \rangle$ IV. $\left\langle \frac{-3}{4}, \frac{4}{5} \right\rangle$

A) 0 B) 1 C) 2 D) 3

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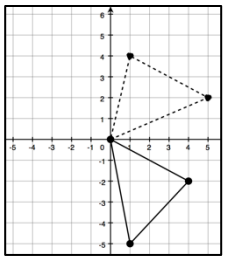
15. A linear transformation of a set of vectors is created by modifying a set of vectors (dotted) into another set (solid) as shown in the figure to the right. What is the transformation matrix?



A) $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$ B) $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$

C) $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$ D) $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$

16. A parabola has focus (–8, –3) and directrix: $x = 5$. Find its equation.

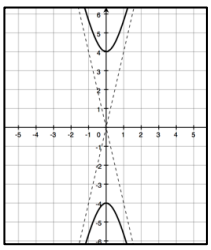
A) $(y+3)^2 = -26\left(x+\frac{3}{2}\right)$ B) $(y+3)^2 = 26\left(x+\frac{3}{2}\right)$

C) $(y+3)^2 = 20(x+8)$ D) $(y+3)^2 = -20(x+8)$

17. Find the value of $\begin{vmatrix} -3 & 5 \\ -2 & 4 \end{vmatrix} \begin{bmatrix} -3 & 5 \\ -2 & 4 \end{bmatrix}$

A) $\begin{bmatrix} 6 & -10 \\ 4 & -8 \end{bmatrix}$ B) $\begin{bmatrix} -1 & -5 \\ -2 & 6 \end{bmatrix}$ C) $\begin{bmatrix} 9 & 15 \\ 4 & 16 \end{bmatrix}$ D) 4

18. The equation of the curve to the right is:



A) $\frac{y^2}{4} - x^2 = 1$ B) $\frac{y^2}{16} - x^2 = 1$

C) $\frac{x^2}{16} - y^2 = 1$ D) $\frac{x^2}{4} - y^2 = 1$

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19. Find the number of intersection points for $y = x^2$ and $\frac{x^2}{16} + \frac{(y-2)^2}{4} = 1$.

A) 0 B) 1 C) 3 D) 4

20. If $\begin{aligned} 5x - 3y - z &= 23 \\ 4x + 2y - 3z &= 14 \\ 7x \quad\quad + 2z &= 6 \end{aligned}$, use matrices to find the product *xyz*.

A) –24 B) 0 C) $\frac{35}{2}$ D) 1,182,282

21. A set of vectors has a linear transformation applied so that its dilation is the same size as the original. Which of the following could be the transformation matrix?

I. $\begin{bmatrix} 8 & 13 \\ 3 & 5 \end{bmatrix}$ II. $\begin{bmatrix} -6 & -7 \\ 7 & 8 \end{bmatrix}$ III. $\begin{bmatrix} -12 & -9 \\ -4 & -3 \end{bmatrix}$

A) I only B) II only C) I and II only D) III only

22. Let $X = \begin{bmatrix} a & b & c \\ d & e & f \end{bmatrix}, Y = \begin{bmatrix} g \\ h \\ i \\ j \end{bmatrix}, Z = \begin{bmatrix} k & l & m & n \\ o & p & q & r \\ s & t & u & v \end{bmatrix}$, which of the following exists?

A) *YXZ* B) *ZYX* C) *XZY* D) *ZXY*

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23. Arrange the following ellipses from the roundest to the flattest.

I. $\frac{x^2}{5}+\frac{y^2}{2}=1$ II. $\frac{x^2}{3}+\frac{y^2}{8}=1$ III. $\frac{x^2}{4}+\frac{y^2}{9}=1$

A) I, II, III B) I, III, II C) II, I, III D) III, I, II

24. If $A=\begin{bmatrix} x & -2 \\ 3 & y \end{bmatrix}$ and $B=\begin{bmatrix} 4 & -3y \\ 2x & -1 \end{bmatrix}$ find BA

A) $\begin{bmatrix} 4x^2 & -6y \\ 6x & -y \end{bmatrix}$

B) $\begin{bmatrix} 12-9y & -8-3y^2 \\ 2x^2-3 & -4x-y \end{bmatrix}$

C) $\begin{bmatrix} 8x & -3xy+2 \\ 12+2xy & -10y \end{bmatrix}$

D) $\begin{bmatrix} x+4 & -2-3y \\ 3+2x & y-1 \end{bmatrix}$

25. To dilate a vector set area by 50% and to rotate it $135°$, use which of the following modification matrices?

A) $\begin{bmatrix} \frac{-\sqrt{2}}{2} & \frac{-\sqrt{2}}{2} \\ \frac{\sqrt{2}}{2} & \frac{-\sqrt{2}}{2} \end{bmatrix}$ B) $\begin{bmatrix} \frac{-\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \\ \frac{-\sqrt{2}}{2} & \frac{-\sqrt{2}}{2} \end{bmatrix}$ C) $\begin{bmatrix} \frac{-1}{2} & \frac{-1}{2} \\ \frac{1}{2} & \frac{-1}{2} \end{bmatrix}$ D) $\begin{bmatrix} \frac{-1}{2} & \frac{1}{2} \\ \frac{-1}{2} & \frac{-1}{2} \end{bmatrix}$

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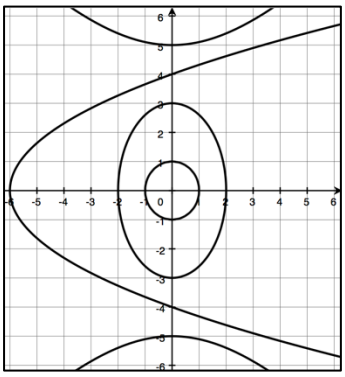
AP Precalculus **Name** _____ **Pd.** _____
Unit 4 Comprehensive Exam Part 2 (Calculator)

1. Shown in the figure to the right are 4 conics having no points of intersection.



a) Find the equation of the circle.

b) Find the equation of the ellipse.

c) The foci of the hyperbola are at the points (0, 7) and (0, –7). Find the equation of the hyperbola. Show your analysis.

d) The focus of the parabola is at the point $\left(\frac{-189}{32},0\right)$. Find the equation of the parabola. Show your analysis.

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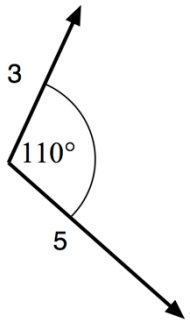
2. A butterfly is flying at 5 miles per hour. It is affected by a 3 mph wind in a direction that is a $110°$ rotation from the direction the butterfly is attempting to move, as shown in the figure below right.

a) On the figure, use a dashed line showing the butterfly's true path based on the wind.



b) Use the law of cosines to find the true speed of the butterfly.

c) Use the law of sines to find the angle that the wind changes the butterfly's intended path.

d) The same problem can be done by assuming that the butterfly is flying east. Assuming that is true, find the butterfly's vector and wind vector.

e) Show that you get the same answer to b) using these vectors.

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3. At a retirement facility, residents are given new remote controls for their TV's that have voice control as well as the standard buttons to change channels. They are given a lesson on how to use it and take it to their apartments to use for a week.

After a week, 90% of the residents are still pushing buttons to change channels while 10% are using the voice feature. Statistics shows that after that for every week thereafter, 70% of residents using buttons will continue to do so while 30% will switch to voice. Of the residents using voice, only 15% will switch back to buttons.

a) Show the information given by an initial state matrix and a transition probability matrix.

b) Determine the percentage of residents using buttons after 2 weeks. Show the calculation you are performing.

c) Determine the percentage of residents using buttons after 3 weeks. Show the calculation you are performing.

d) Two months (8 weeks) after the initial rollout of the new remotes, determine the percentage of residents using buttons. Show the calculation you are performing.

e) Use your calculation method for a year of use to predict the percentage of residents who will always use buttons.

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