MA 154 Exam 3 Key Fall 2001

Place your answers in the spaces provided. You must show correct work to receive credit.

(10 pts.) 1. Given the vectors $a = -7i + 2j$ and $b = -8i - 4j$, find $4a + 5b$.

$$4a = -28i + 8j$$

$$5b = -40i - 20j$$

$$4a + 5b = -68i - 12j$$

$-68i - 12j$

(6 pts.) 2. Find the exact value of $|4 - 7i|$.

$$\sqrt{(4)^2 + (-7)^2}$$

$$\sqrt{16 + 49}$$

$$\sqrt{65}$$

$\sqrt{65}$

(10 pts.) 3. Given the vectors < 5, –6 > and < –3, 7 >, find the angle between them.
Round your answer to the nearest degree.

$$\cos\theta = \frac{(5)(-3) + (-6)(7)}{\left(\sqrt{(5)^2 + (-6)^2}\right)\left(\sqrt{(-3)^2 + (7)^2}\right)}$$

$$\cos\theta = \frac{-15 + (-42)}{\left(\sqrt{25 + 36}\right)\left(\sqrt{9 + 49}\right)}$$

$$\cos\theta = \frac{-57}{\left(\sqrt{61}\right)\left(\sqrt{58}\right)}$$

$$\cos\theta = \frac{-57}{\sqrt{3535}}$$

$$\cos\theta = \frac{-57}{59.4559}$$

$$\cos\theta = -0.9587$$

$$\theta = 163.47°$$

$\theta = 163°$

MA 154 Exam 3 Key Fall 2001

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(10 pts.) 4. Express the complex number in trigonometric form, with $0 \le \theta < 2\pi$.

$3 - 3\sqrt{3}i$

$\tan\theta = \frac{-3\sqrt{3}}{3} = -\sqrt{3} \qquad \theta = -\frac{\pi}{3}$

$\theta_R = \frac{\pi}{3}$, Since θ is in QIV, $\theta = \frac{5\pi}{3}$

$\left|3 - 3\sqrt{3}i\right| = \sqrt{(3)^2 + \left(3\sqrt{3}\right)^2} = \sqrt{9 + 27} = \sqrt{36} = 6$

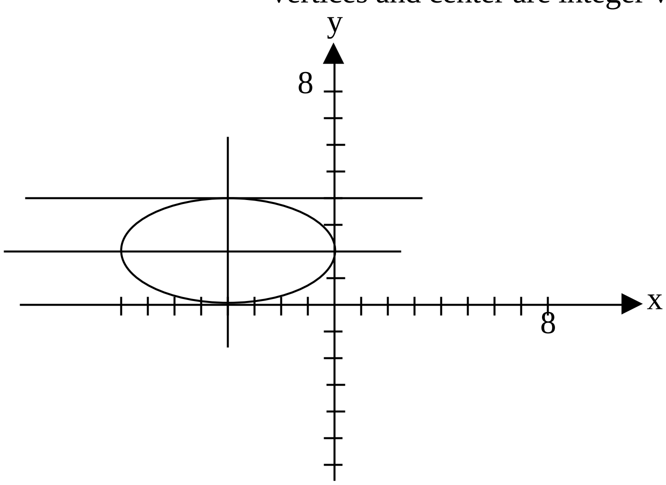
$6\left[\cos\left(\frac{5\pi}{3}\right) + i\sin\left(\frac{5\pi}{3}\right)\right]$

$6\left[\cos\left(\frac{5\pi}{3}\right) + i\sin\left(\frac{5\pi}{3}\right)\right]$

OR:

$6\,cis\left(\frac{5\pi}{3}\right)$

(12 pts.) 5. Find the standard form of the equation of the conic. Assume the coordinates of the vertices and center are integer values.



Center $(-4,2)$

$V, V': (-8,2), (0,2), a = 4$

$W, W': (-4,4), (-4,0), b = 2$

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

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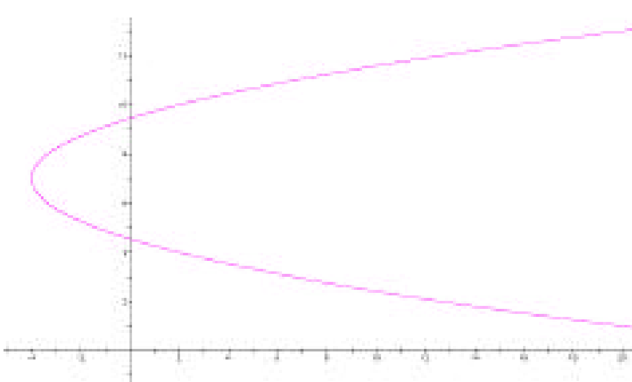
(12 pts.) 6. Find an equation of the parabola with vertex V(– 4, 7), axis parallel to the x-axis and passing through the point P(2, 4).



$(x+4) = a(y-7)^2$

$(2+4) = a(4-7)^2$

$6 = a(-3)^2$

$6 = 9a$

$a = \frac{6}{9} = \frac{2}{3}$

$(x+4) = \frac{2}{3}(y-7)^2$

$(x+4) = \frac{2}{3}(y-7)^2$

MA 154 Exam 3 Key Fall 2001

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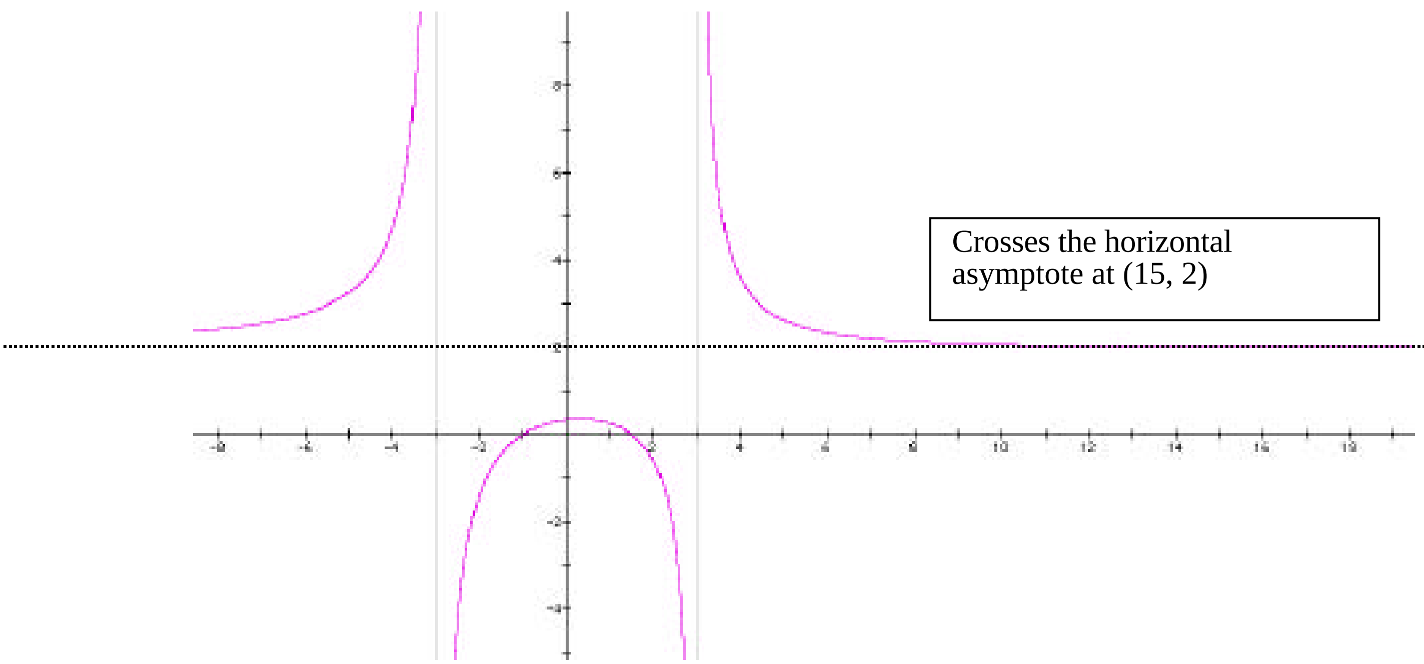
(16 pts.) 7. Sketch the graph of f. Find the **equation(s)** of the vertical and horizontal asymptotes, and all the intercepts. Use the x|y table to justify points in each region of the sketch. Use dotted lines to represent the asymptotes.

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

x	y
-20	2.09
-4	4.7
-2	-1.4
1	0.25
2	-0.6
4	3.6
5	2.6
15	2
20	1.98

x-intercept(s):	$\left(\frac{3}{2}, 0\right)$ $(-1, 0)$
y-intercept(s):	$\left(0, \frac{1}{3}\right)$
Vertical asymptote(s):	$x = 3, x = -3$
Horizontal asymptote(s):	$y = 2$



MA 154 Exam 3 Key Fall 2001

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(12 pts.) 8. The magnitudes and directions of two forces acting at a point P are 70lbs., $200°$ and 40lbs., $120°$. (Angles are measured from the positive x-axis.) To one decimal place, approximate the magnitude and the direction of the resultant vector.

$a = \langle 70\cos 200°, 70\sin 200° \rangle = \langle -65.778, -23.941 \rangle$

$b = \langle 40\cos 120°, 40\sin 120° \rangle = \langle -20.000, 34.641 \rangle$

$r = a + b = \langle -85.778, 10.700 \rangle \quad \tan\theta = \dfrac{10.700}{-85.778} = -0.1247$

$\theta = -7.110°$, since r is in QII, $\theta = 180° - 7.110° \quad \theta = 172.9°$

$\|r\| = \sqrt{(-85.778)^2 + (10.700)^2} = \sqrt{7357.9 + 114.5} = \sqrt{7472.4} \quad \|r\| = 86.4$

------ OR: ------------------------------

$200° - 120° = 80° \quad 180° - 80° = 100°$

$m^2 = 40^2 + 70^2 - 2(40)(70)\cos(100°)$

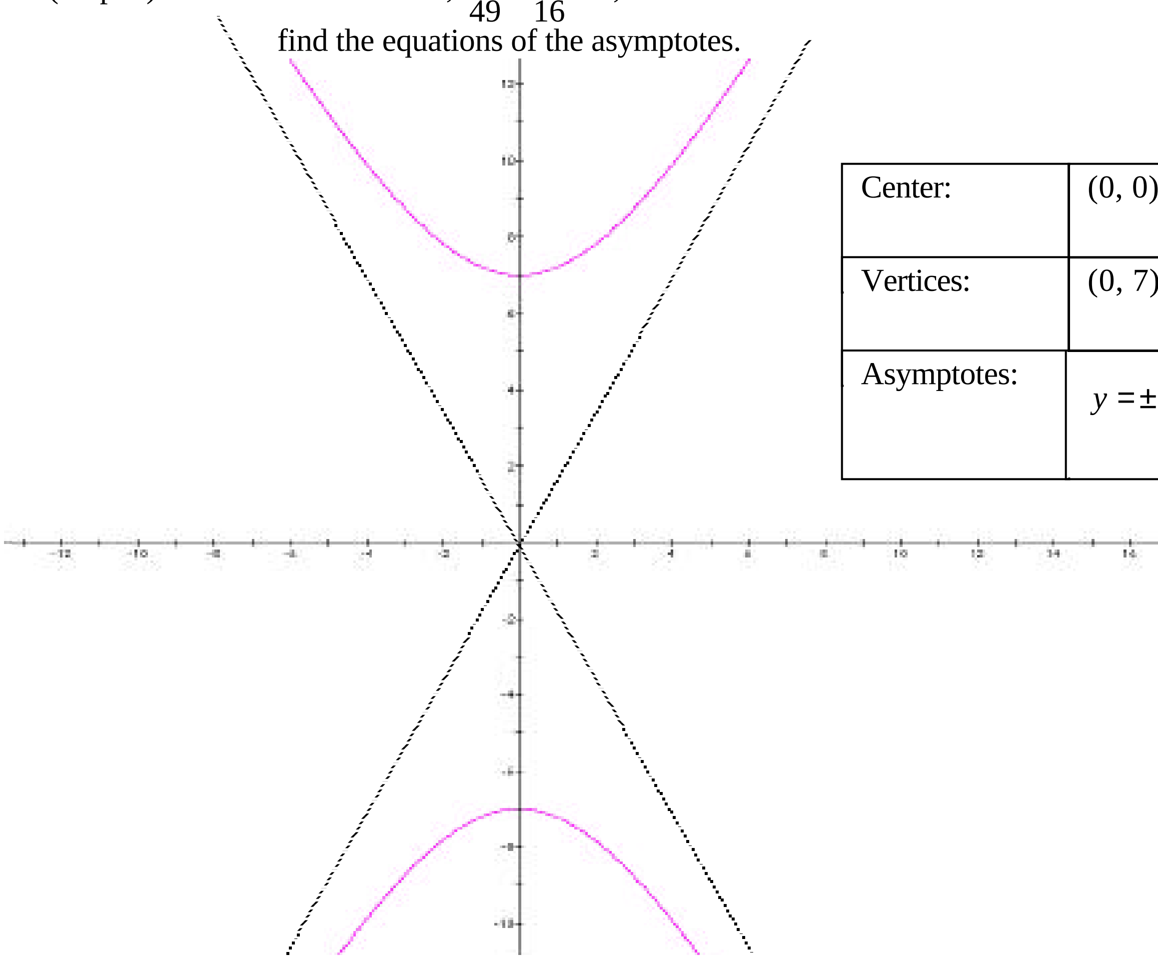
$m = 86.4$

$\dfrac{\sin\theta}{70} = \dfrac{\sin 100°}{86.4} \quad \sin\theta = 0.7979 \quad \theta = 52.92°$

$52.92° + 120° = 172.92°$

Magnitude	86.4 *lbs.*
Direction =	172.9°

(12 pts.) 9. For the conic, $\dfrac{y^2}{49} - \dfrac{x^2}{16} = 1$, find the coordinates of the center and the vertices. Also, find the equations of the asymptotes.



Center:	(0, 0)
Vertices:	(0, 7),(0,–7)
Asymptotes:	$y = \pm\dfrac{7}{4}x$