1. a) $\|v\|=12 \quad \theta = 122°$

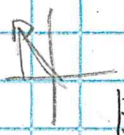
$x = 12\cos 122° \quad y = 12\sin 122° \quad \langle -6.359, 10.177 \rangle$

b) $\|u\| = 2 \quad \theta = 307°$

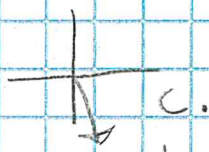
$x = 2\cos 307° \quad y = 2\sin 307° \quad \langle 1.204, -1.597 \rangle$

c) $\langle -4, -9 \rangle$ d) $\langle 10, 9 \rangle$

2a. $\|v\| = \sqrt{4+49} = \sqrt{53} \quad \tan\theta = \frac{7}{2} \quad \theta = 105.945°$



b. $\|v\| = \sqrt{1+64} = \sqrt{64} \quad \tan\theta = \frac{-8}{1} \quad \theta = 277.125°$



c. $\langle -11, -5 \rangle \quad \|v\| = \sqrt{121+25} = \sqrt{146} \quad \tan\theta = \frac{-5}{11} \quad \theta = 204.444°$

d. $\langle 7, 3 \rangle \quad \|v\| = \sqrt{49+9} = \sqrt{58} \quad \tan\theta = 3/7 \quad \theta = 23.199°$

3a. $v+w = (-3+10)i + (8-4)j = 7i + 4j$

b. $w - v = (10 - -3)i + (-4-8)j = 13i - 12j$

c. $3v + 2w = (3(-3) + 2(10))i + (3(8) + 2(-4))j = 11i + 16j$

d. $-4v - w = (-4(-3) - 10)i + (-4(8) - (-4))j = 2i - 28j$

4a. $(r = 3\cos\theta)\, r$

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

$x^2+y^2 \qquad x$

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

b. $r = \cos 3\theta + \sin 2\theta \Rightarrow r = \cos(2\theta + \theta) + 2\sin\theta\cos\theta$

$r = \cos 2\theta\cos\theta - \sin 2\theta\sin\theta + 2\sin\theta\cos\theta$

$= \underline{2\cos^3\theta} - \cos^2\theta - \underline{2\sin^2\theta\cos\theta} + 2\sin\theta\cos\theta$

$r^{\theta} = r\cos\theta\,(2r\cos^2\theta - r - 2r\sin^2\theta + 2r\sin\theta)$

$r^4 = x(2x^2 - r^2 - 2y^2 + 2ry)$

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

$(x^2+y^2)^2 = x(x^2 - 3y^2 + 2y\sqrt{x^2+y^2})$

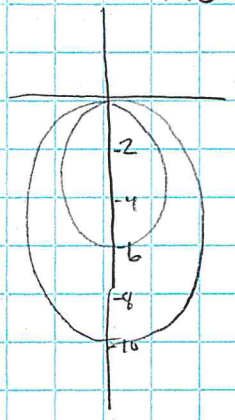
$(x^2+y^2)^2 = x^3 - 3xy^2 + 2xy\sqrt{x^2+y^2}$

c. $(-3, 70°)$ $x = -3\cos 70°$ $y = -3\sin 70°$ $\langle -1.026, -2.819 \rangle$

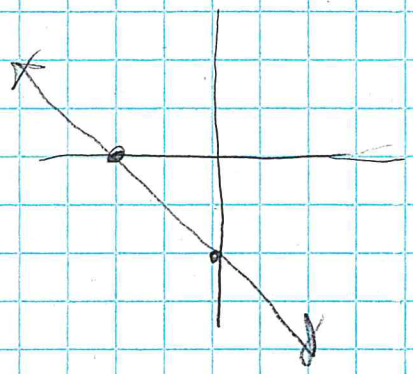
d. $(9, 190°) \Rightarrow$ $x = 9\cos 190°$ $y = 9\sin 190°$ $\langle -8.863, -1.563 \rangle$

5a $r = -4\cos 6\theta$
12 petal rose

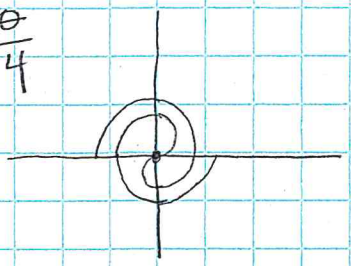
b. $2 - 8\sin\theta = r$



c. $r = \frac{-4}{\cos\theta + \sin\theta}$



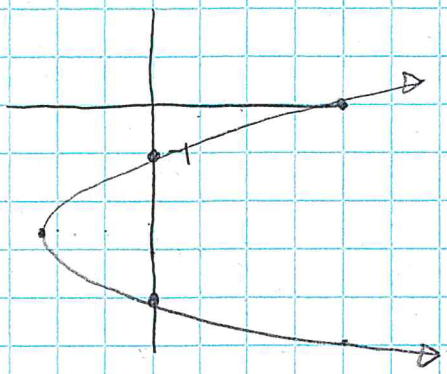
d. $r^2 = \frac{\theta}{4}$



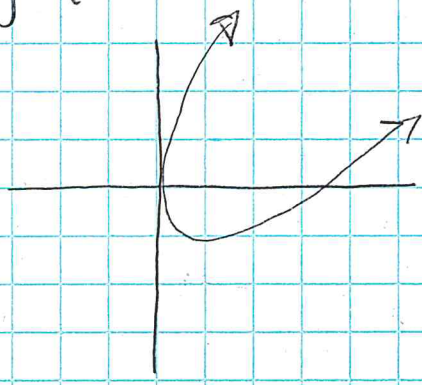
6. a) $x = t^2 + 3t$
$y = t - 1$ $t = y + 1$ $\Rightarrow x = (y+1)^2 + 3(y+1) = y^2 + 2y + 1 + 3y + 3$

$\boxed{x = y^2 + 5y + 4}$

$(y+4)(y+1)$



b. $x = t^2$
$y = t^2 - 4t$ $\Rightarrow y = x - 4\sqrt{x}$



7. a) $3, -6, 12, -24, \ldots$

$a_n = 3(-2)^{n-1}$

$a_1 = 3$

$a_n = a_{n-1}(-2)$

b) $27, 19, 11, 3, \ldots, -101$

$-101 = 27 - 8(n-1)$

$-128 = -8(n-1)$

$16 = n-1$

$a_n = 27 - 8(n-1) \quad 1 \le n \le 17$

$a_1 = 27$

$a_n = a_{n-1} - 8 \quad 2 \le n \le 17$

c. $\frac{1}{2}, \frac{1}{6}, \frac{1}{12}, \ldots, \frac{1}{132}$

$a_n = \frac{1}{n(n+1)} \quad 1 \le n \le 11$

$\frac{1}{1\cdot 2} \quad \frac{1}{2\cdot 3} \quad \frac{1}{3\cdot 4} \quad \frac{1}{4\cdot 5} \quad \frac{1}{11\cdot 12}$

$a_1 = \frac{1}{2}$

$a_n = a_{n-1}\left(\frac{n-1}{n+1}\right) \quad 2 \le n \le 11$

✓ $\frac{1}{2}, \frac{1}{2}\left(\frac{1}{3}\right), \frac{1}{6}\left(\frac{2}{4}\right), \frac{1}{12}\cdot\left(\frac{3}{5}\right)$ ☺

$n=1 \quad n=2 \quad n=3 \quad n=4$

8. $a_n = (-1)^n(3n)$

a) $0, -3, 6, -9, 12$

b) $a_1 = 7$

$a_n = 4 + 2a_{n-1}$

$7, 18, 40, 84, 172$

c) $a_1 = 2$

$a_n = n + a_{n-1}$

$2, 4, 7, 11, 16$

9. a) $\sum_{n=1}^{\infty} (-1)^n \left(\frac{2}{3}\right)^{n-1}$

b) $\sum_{n=1}^{20} 9 - 3(n-1)$

$-48 = 9 - 3(n-1)$

$19 = n-1$

$n = 20$

c. $\frac{1}{2} + \frac{4}{2} + \frac{9}{2} + \frac{16}{2} + \frac{25}{2} + \frac{36}{2} + \ldots \quad \sum_{n=1}^{\infty} \frac{n^2}{2}$

10 d) $a_1 = 200$

$a_n = -2.5$

$S = \left(\frac{200 + -2.5}{2}\right)82 = 8097.5$

e) $a = \frac{1}{6} \quad r = 2 \quad r^n = 2^{30}$

$S = \frac{\frac{1}{6}(1-2^{30})}{1-2} = \frac{-1}{6}(1-2^{30}) = 178956970.5$

f) $a = -5 \quad r = 3/2 > 1$ Diverges

g) $a = 9 \quad r = 2/3$

$S = \frac{9}{1-2/3} = \frac{9}{1/3} = 27$

11. a) $y = \frac{\sqrt{x-4}}{x+1}$ $x \geq 4$ $\neq x \neq -1$ $\quad x \geq 4$

b) $y = -2e^{-x} + 4 = \frac{-2}{e^x} + 4$

D: $x \in \mathbb{R}$
R: $y \in (-\infty, 4)$

c) D: $x \in \mathbb{R}$
R: $y \leq 3$

d. $x \in \mathbb{R}$: D
$y \geq -2$: R

12. a) $y = 2\sin 3\left(x + \frac{2\pi}{5}\right)$ ↑ 0 ↔ $2\pi/5$ freq: 3 amp: 2

b) ↔ 3 ↕ 7 v.dil bafo 1/5 reflection across x-axis

c) ← 4 ↓ 2 d) ← 6 ↑ 1 v.d. bafo 4

13 a) $a = 3$
freq = 2 ⇒ period = π
phase shift: R $\pi/2$
$2x - \pi$
$2(x - \pi/2)$

b) $a = \frac{5}{3}$ reflection across x
freq = π period = 1
phase shift: L 6
$\pi(x+6)$

c) $a = 2$
period = $\frac{2\pi}{3}$
phase shift: L $\pi/2$

d) $a = 1$ $\quad 2b = \pi$
period = 2
phase shift: none

14. a) $y = 2\sin 8(x - \pi)$

$\frac{4}{\pi/4} \cdot b = 2\pi \frac{4}{4}$

b) $y = \frac{3}{4}\cot\frac{\pi}{2}(x+4)$

$\frac{2}{2} \cdot b = \frac{\pi}{2}$

15. $2\cot x + 1 = -3$
$\cot x = -2$

a) $x = \cot^{-1}(-2)$

$x = .464, 2.6779, 5.820$

b) $\csc(2x) = 4$

$x = -3.015, -1.697, .126, 1.444, 3.268, 4.586,$

15. c. $-\tan x = 2\cos x$

$\frac{-\sin x}{\cos x} = 2\cos x \Rightarrow -\sin x = 2\cos^2 x \Rightarrow -\sin x = 2 - 2\sin^2 x$

$\Rightarrow 2\sin^2 x - \sin x - 2 = 0$

$x = -2.246, -.896, 4.038, 5.387$

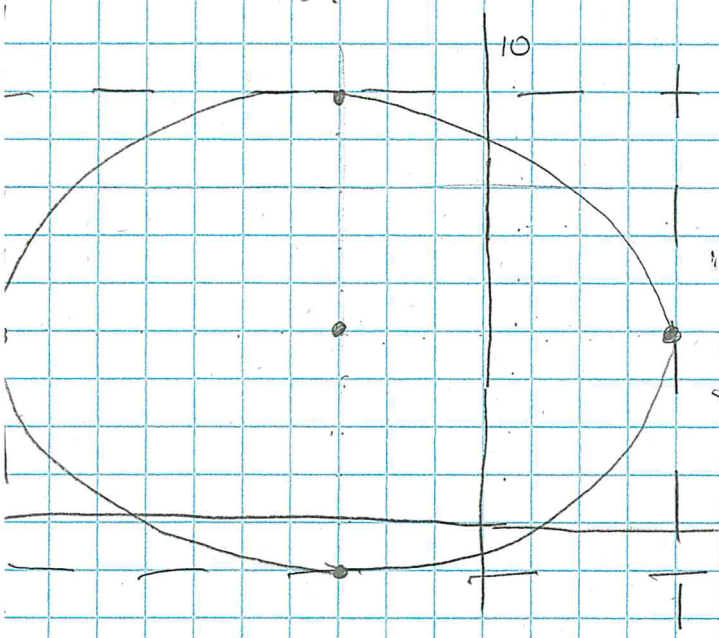
d. $\sec\frac{1}{2}x = 3\sin\frac{1}{2}x \quad x = 1.571$ or $\frac{\pi}{2}$

16. $\cos x = \frac{5}{8} \quad c^2 + s^2 = 1 \quad \left(\frac{5}{8}\right)^2 + s^2 = 1 \Rightarrow s^2 = 1 - \frac{25}{64} = \frac{39}{64}$

$s = \pm\frac{\sqrt{39}}{8} \quad \tan x = \frac{\sqrt{39}}{5}$

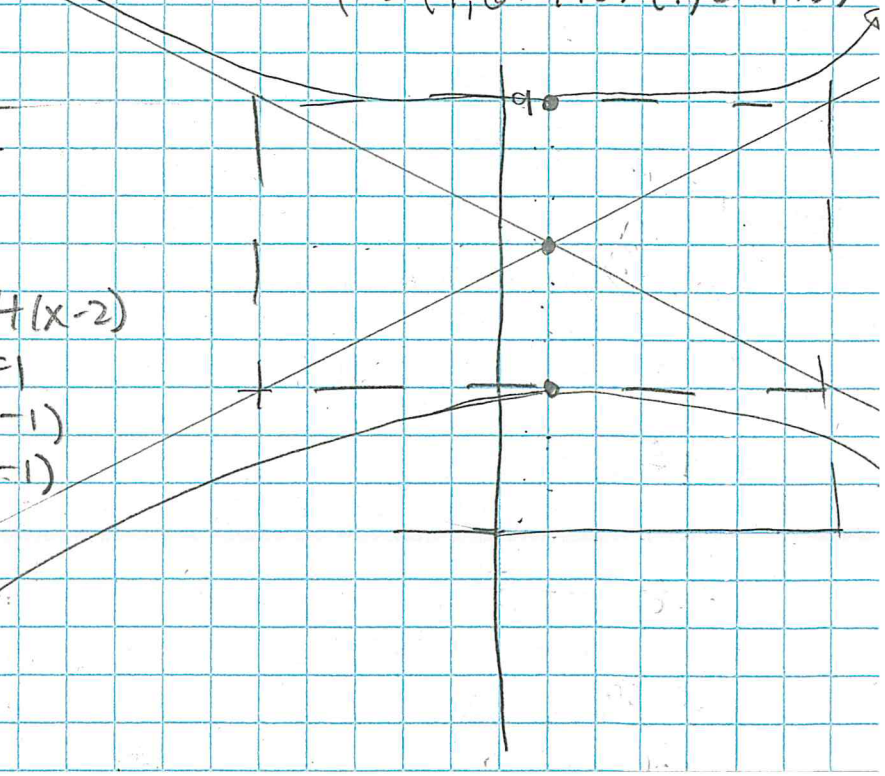
17. a $\frac{(x+3)^2}{49} + \frac{(y-4)^2}{25} = 1$

c: $(-3, 4)$
f: $(-3+2\sqrt{6}, 4)(-3-2\sqrt{6}, 4)$
V: $(4,4)(-10,4)$ & $(-3,9)(-3,-1)$



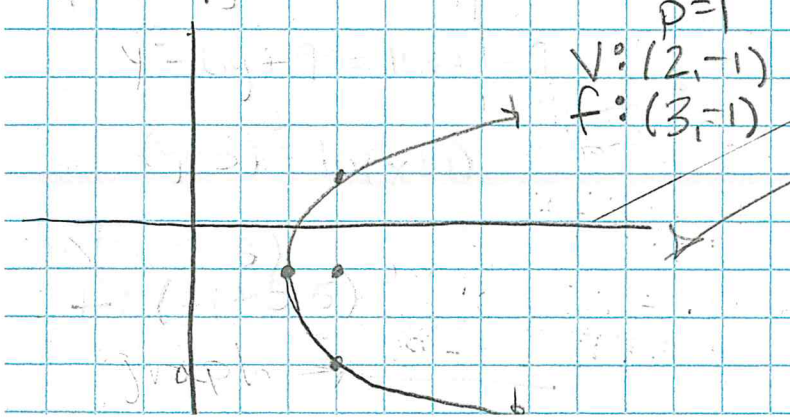
17. b) $\frac{(y-6)^2}{9} - \frac{(x-1)^2}{36} = 1$

c: $(1,6)$
V: $(1,9)(1,3)$
f: $(1, 6+\sqrt{45})(1, 6-\sqrt{45})$

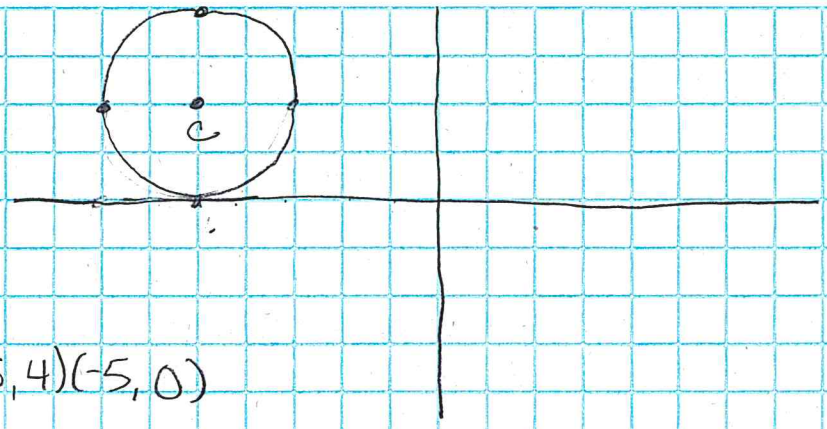


17. c) $\frac{(y+1)^2}{4} = (x-2) \Rightarrow (y+1)^2 = 4(x-2)$

$p = 1$
V: $(2,-1)$
f: $(3,-1)$



d. $\frac{(x+5)^2}{4} + \frac{(y-2)^2}{4} = 1$



C: (-5, 2)
f: (-5, 2)
V: (-3, 2)(-7, 2) ; (-5, 4)(-5, 0)

18. a) $x^2 + y^2 - 4x - 6y + 13 = 0$

$x^2 - 4x + 4 + y^2 - 6y + 9 = -13 + 13$

$(x-2)^2 + (y-3)^2 = 0$

point?

b) $2x^2 - 2y^2 = 8x + 12y - 8 = 0$

$2x^2 - 8x - 2y^2 + 12y = 8$

$2(x^2 - 4x + 4) - 2(y^2 - 6y + 9) = 8 + 8 - 18$

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

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

hyperbola

c) $\frac{4y^2 - 24y - 40x - 4 = 0}{4}$

$y^2 - 6y - 10x - 1 = 0$

$y^2 - 6y + 9 = 10x + 1 + 9$

$(y-3)^2 = 10x + 10$

$(y-3)^2 = 10(x+1)$

parabola

19. a) $c^2 = 8^2 + 11^2 - 2 \cdot 8 \cdot 11 \cos 37°$

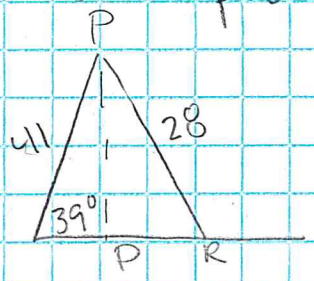
$c^2 = 50.287$

$c = 7.09$

$\frac{\sin 37°}{7.09} = \frac{\sin A}{8} \Rightarrow A = 42.76$

$B = 100.240°$

19b.



1st Δ

$\sin 39 = \frac{h}{41}$

$h = 25.8 < 28 < 41$

two Δ's.

$\frac{\sin 39°}{28} = \frac{\sin R}{41}$

$R = 67.147°$
$P = 73.853°$
$p = 42.737$

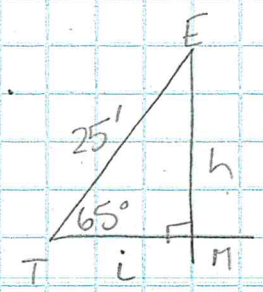
$\frac{\sin 39}{28} = \frac{\sin 73.853°}{P}$

2nd Δ

$R' = 112.853°$
$P' = 28.147°$
$p' = 20.989$

$\frac{\sin 39°}{28} = \frac{\sin 28.147°}{P'}$

19c.

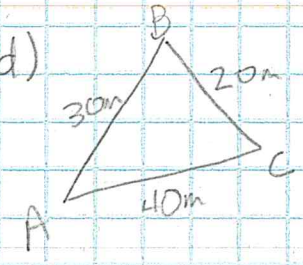


$\sin 65 = \frac{h}{25}$ $\quad h = 22.658'$

$m\angle E = 25°$

$\cos 65° = \frac{i}{25}$ $\quad i = 10.565'$

d)



$30^2 = 20^2 + 40^2 - 2(20)(40)\cos C$ $\quad C = 46.567°$

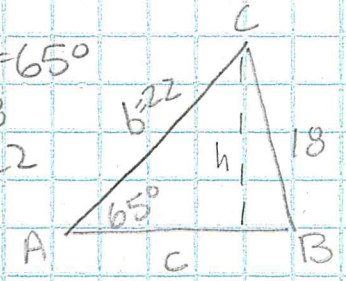
$40^2 = 20^2 + 30^2 - 2(20)(30)\cos B$ $\quad B = 104.478°$

$A = 28.955°$

e) $m\angle A = 65°$

$a = 18$

$b = 22$



$h = 22\sin 65° = 19.94$

$18 < 19.94$

Not possible.

20. $\cos 2\theta = 2\cos^2\theta - 1$

$= 2\left(\frac{-2}{3}\right)^2 - 1$

$= \frac{8}{9} - 1$

$= \frac{-1}{9}$

$\cos\frac{\theta}{2} = \pm\sqrt{\frac{1+\cos\theta}{2}} = \pm\sqrt{\frac{1-\frac{2}{3}}{2}} = \pm\sqrt{\frac{\frac{1}{3}}{2}}$

$= \pm\sqrt{\frac{1}{6}} = \pm\frac{1}{\sqrt{6}}$ or $\pm\frac{\sqrt{6}}{6}$ or $\pm .408$

$-\frac{1}{\sqrt{6}}$ or $-\frac{\sqrt{6}}{6}$ or $-.408$

21. a) $\sin x + \cos x \cot x$

$\frac{\sin x}{\sin x} \cdot \sin x + \frac{\cos x \cdot \cos x}{\sin x}$

$\frac{\sin^2 x + \cos^2 x}{\sin x}$

$\frac{1}{\sin x}$

$\boxed{\csc x}$

b. $\frac{\sec x - \cos x}{\sec x} \Rightarrow \frac{\sec x}{\sec x} - \frac{\cos x}{\sec x}$

$1 - \cos x \cdot \frac{\cos x}{1}$

$1 - \cos^2 x$

$\boxed{\sin^2 x}$

c) $\tan x + \frac{\cos x}{1+\sin x} = \frac{\sin x}{\cos x} + \frac{\cos x}{1+\sin x}$

$= \frac{\sin x(1+\sin x) + \cos^2 x}{\cos x(1+\sin x)} = \frac{\sin x + \sin^2 x + \cos^2 x}{\cos x(1+\sin x)}$

$= \frac{1+\sin x}{\cos x(1+\sin x)} = \frac{1}{\cos x} = \boxed{\sec x}$

d) $\frac{\sec x \sin^2 x}{1+\sec x} = \frac{\frac{1}{\cos x}\sin^2 x}{1+\frac{1}{\cos x}} = \frac{\frac{\sin^2 x}{\cos x}}{\frac{\cos x+1}{\cos x}}$

$= \frac{\sin^2 x}{\cos x+1} = \frac{1-\cos^2 x}{1+\cos x} = \frac{(1+\cos x)(1-\cos x)}{1+\cos x} = \boxed{1-\cos x}$