① $f(x)=\frac{x}{3-x}=y \Rightarrow g(x)=\frac{y}{3-y}=x$

B

$\frac{y}{3-y}=x$, $\frac{3-y}{y}=\frac{1}{x}$, $\frac{3}{y}-1=\frac{1}{x}$, $\frac{1}{y}=\frac{\frac{1}{x}+1}{3}$

$y=\frac{3}{\frac{1}{x}+1}=\boxed{\frac{3x}{1+x}=g(x)}$ $\quad g(-2)+g(2)=\frac{-6}{-1}+\frac{6}{3}=\boxed{8}$ B

② B

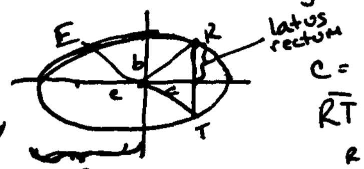
	1 × 3	
-9	-3 × 4	4
-20	-5 × 4	-12
-20	-5 × 0	0
0	-1 × 2	10
+ -2	1 × 3	+ -3
-51		-1

$\left|\frac{-51-(-1)}{2}\right|=\boxed{25}$

③ Distance from focus to directrix of a parabola = 2p.

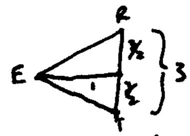
A Latus Rectum length = 4p. $(4)\left(\frac{3}{2}\right)=\boxed{6}$ A

④ C



$c=a^2-b^2=1$

$\overline{RT}=2(\text{latus rectum})=2\left(\frac{2b^2}{a}\right)=3$



$\overline{ER}=\overline{ET}=\sqrt{1^2+\left(\frac{3}{2}\right)^2}=\frac{\sqrt{13}}{2}$

$\overline{ER}+\overline{ET}+\overline{RT}=\boxed{3+\sqrt{13}}$

⑤ for a hyperbola: $b^2=a^2(e^2-1)$ and L.R. $=\frac{2b^2}{a}=\ell$, $e=\ell=4$

~~A~~ $b^2=a^2(15)$, $a=\frac{2b^2}{4}$

$b^2=\left(\frac{2b^2}{4}\right)^2(15) \Rightarrow b^2=\left(\frac{b^4}{4}\right)(15)$, $(4/15)=b^2$, $b=\frac{2}{\sqrt{15}}$

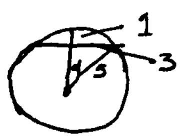
2b = conjugate axis = $\boxed{\frac{4\sqrt{15}}{15}}$

⑥ $\hat{x}=\langle 0,3,0\rangle$ $\quad\hat{y}=\langle 1,0,0\rangle$ $\quad\hat{z}=\langle 1,1,1\rangle$

D $\hat{y}\times\hat{z}=\langle 0,-1,1\rangle$. $\quad|\hat{x}\cdot(\hat{y}\times\hat{z})|=|-3|=\boxed{3}$

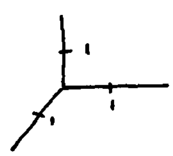
⑦ $V=\frac{500\pi}{3}=\frac{4}{3}\pi r^3$, r = 5 cm.

D



radius of base = 3 cm, $A=\boxed{9\pi\ cm^2}$

⑧ B



A = -D = B = C . for gcd(A, B, C, D) = 1, A = B = C = 1, D = -1.

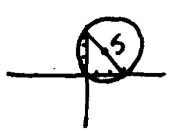
$A+B+C+D=\boxed{2}$

⑨ (ρ,θ,ϕ) $\quad x=\rho\sin\phi\cos\theta$ $\quad y=\rho\sin\phi\sin\theta$ $\quad z=\rho\cos\phi$

E $\left(4,\frac{\pi}{4},\frac{\pi}{2}\right)\Rightarrow(2\sqrt{2},2\sqrt{2},0)$ $\quad\left(3,\frac{\pi}{6},\frac{\pi}{3}\right)\Rightarrow\left(\frac{5}{4},\frac{3\sqrt{3}}{4},\frac{3}{2}\right)$

$D=\sqrt{(2\sqrt{2}-5/4)^2+\left(2\sqrt{2}-\frac{3\sqrt{3}}{4}\right)^2+\left(0-\frac{3}{2}\right)^2}=\boxed{2.7}$

⑩ $r=3\cos\theta+4\sin\theta \Longrightarrow$



$r=\frac{5}{2}$, $A=\boxed{\frac{25\pi}{4}}$

B

⑪ $(x^2+y^2-ax)^2 = a^2(x^2+y^2) \Rightarrow (r^2 - ar\cos\theta)^2 = a^2 r^2$

A

$r^2 - ar\cos\theta = ar$

$r^2 = ar(1+\cos\theta)$, $r = a(1+\cos\theta)$

$\boxed{\text{cardiod}}$

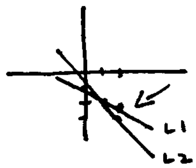
⑫ $9x^2+25y^2+36x-150y+36=0$

D $\frac{(x+2)^2}{25} + \frac{(y-3)^2}{9} = 1$ ellipse , center $= (-2,3)$

$c = \sqrt{a^2-b^2} = 4$. foci @ $\boxed{(-2\pm 4, 3)}$

⑬

E



intersection at $(1,-2)$. Find vectors at $x=2$,

L1 $- \langle 1, -\frac{1}{2} \rangle = \hat{a}$, L2 $- \langle 1, -\frac{4}{3} \rangle = \hat{b}$

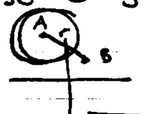
$\cos\theta = \frac{a \cdot b}{\|a\|\|b\|}$, $\boxed{\theta = 12.1^\circ}$

⑭ $3 = 4A + 2C + M$ ← system of 3 equations

A $-1 = 1A + {-1}C + M$

$0 = 9A + {-3}C + M$ $A = \frac{11}{30}$ $B = \frac{29}{30}$ $C = \frac{-2}{3}$ $\boxed{A+B+C = \frac{14}{15}}$

⑮ $x^2+y^2+4x-12y+31=0$



B $(x+2)^2 + (y-6)^2 = 9$, $r=3$.

length of $\overline{AB}$, $A = (-2,6)$ $B = (1,2) = \sqrt{(6-2)^2 + (-2-1)^2} = 5$

$\overline{AB} - r = 5 - 3 = \boxed{2}$

⑯ $P_1 = (2,7)$ $P_2 = (8,2)$ $\frac{8-2}{3} = 2$ $\frac{2-7}{3} = \frac{-5}{3}$

C $(2+2, 7 + \frac{-5}{3}) = \boxed{(4, \frac{16}{3})}$

⑰ $\tan(2\theta) = \frac{B}{A-C}$. $\frac{B}{A-C} = \frac{2}{0} \Rightarrow$ undefined. $\tan(90)$ or $\tan(\frac{\pi}{2})$ = undef.

B $2\theta = \frac{\pi}{2}$, $\boxed{\theta = \frac{\pi}{4}}$

⑱ $x^2-4y^2-8x-16y-16=0 \Rightarrow \frac{(x-4)^2}{16} - \frac{(y+2)^2}{4} = 1$

D $a=4$, $b=2$. asymptote $\to y = \frac{-x}{2}$, $2y+x=0$

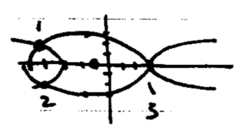
$\boxed{A+B+C = 3}$

⑲ pt $(6,2)$ on $5x-12y-6=0$, . distance $(6,2)$ to $5x-12y+33=0$

B $\frac{|5(6)-12(2)+33|}{\sqrt{5^2+12^2}} = \boxed{3}$

⑳ $9y^2-4x^2+36=0 \Rightarrow \frac{x^2}{9} - \frac{y^2}{4} = 1$

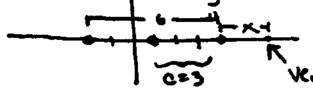
C $9x^2+16y^2-18x-135=0 \Rightarrow \frac{(x-1)^2}{16} + \frac{y^2}{9} = 1$



$\boxed{3}$ pts of intersection

㉑ center ½ way between foci $(-2,0)$, $(4,0) \Rightarrow (1,0)$

C



$6+2x=10$, $x=2$.

vertex Distance from center → vertex = 5 ⇒ major axis = 0

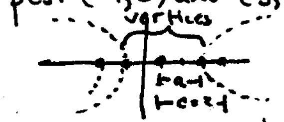
$c = 3 = \sqrt{a^2-b^2}$, $a^2 = 25$, $b^2 = 16$, $b = 4$

$$\boxed{\frac{(x-1)^2}{25} + \frac{y^2}{16} = 1}$$

(22) center ½-way between foci $(-2,0)$ & $(4,0) \Rightarrow (1,0)$.

A $\quad c$ = dist. from focus → center $= 3 = \sqrt{a^2+b^2}$

pts. $(-1,0)$ and $(3,0)$ fit definition (positive difference of distan



a = distance from center to vertex $= 2$.

$3 = \sqrt{a^2+b^2}$, $a^2 = 4$, $b^2 = 5$

hyperbola w/ eq. $\boxed{\dfrac{(x-1)^2}{4} - \dfrac{y^2}{5} = 1}$

(23) g and f are inverses. g is f flipped over the line $y=x$

B (rotated 180°). $-g$ flips image over x-axis ($y=0$).

$h(x) = \boxed{-g(x)}$

(24) $x^2+y^2+Ax+By+C=0 \qquad (\overset{x}{-4},\overset{y}{-1})\ (\overset{x}{1},\overset{y}{-1})\ (\overset{x}{-1},\overset{y}{4})$

D plug in all values of x, y in pts. $\Rightarrow$ $16+1+ -4A + -B + C = 0$

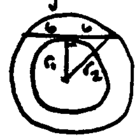
$1+1+A+ -B + C = 0$

$1+16+ -A + 4B + C = 0$

solve system of 3-equations → $A=3 \quad B=\frac{-9}{5} \quad C=\frac{-34}{5} \quad A+B+C = \boxed{-5}$

(25)

D

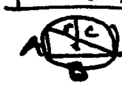


Area between 2 circles $= \pi(r_2)^2 - \pi(r_1)^2 = \pi[(r_2)^2$

$6^2 + (r_1)^2 = (r_2)^2 \Rightarrow (r_2)^2 - (r_1)^2 = 36$

Area $= \boxed{\pi(36)}$

(26) radius $= \dfrac{ABC}{4(\text{Area})}$ for



$s = \frac{4+4+6}{2} =$

A

Heron's Formula, Area $= \sqrt{(7)(7-6)(7-4)(7-4)} = 3\sqrt{7}$

Area of circle $= \pi r^2 = \pi\left(\dfrac{ABC}{4(\text{Area})}\right)^2 = \pi\left(\dfrac{4\cdot 6}{3\sqrt{7}}\right)^2 = \boxed{\dfrac{64\pi}{7}}$

(27) $D+S = 2M \qquad DS = M^2 \qquad$ <u>Law of cosines</u>

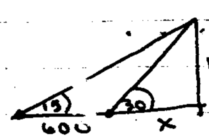
C $\quad D^2 + 2DS + S^2 = 4M^2 \qquad M^2 = \underbrace{D^2+S^2}_{2M^2} - \underbrace{2DS}_{2M^2}\cos M$

$D^2+S^2 = 2M^2$

$M^2 = 2M^2(1-\cos M)$, $\cos M = \frac{1}{2}$ $\boxed{M = \frac{\pi}{3}}$

(28)

A



$\tan 15 = \dfrac{h}{600+x} \qquad \tan 30 = \dfrac{h}{x} \Rightarrow x = \dfrac{h}{\tan 30}$

$\tan 15 = \dfrac{h}{600+\frac{h}{\tan 30}} \Longrightarrow 600 + \dfrac{h}{\tan 30} = \dfrac{h}{\tan 15}$

$\dfrac{600}{h} = \dfrac{1}{\tan 15} - \dfrac{1}{\tan 30} \qquad h = \dfrac{600}{\frac{1}{\tan 15} - \frac{1}{\tan 30}} = \boxed{300}$

(29) at a pt. 2 inches from the center, you will travel $2(2\pi)$ inches/rotation

D $\quad \left(4500 \frac{\text{rot}}{\text{min}}\right)\left(\frac{4\pi \text{ inch}}{1 \text{ rot}}\right)\left(\frac{1 \text{ ft}}{12 \text{ in}}\right)\left(\frac{1 \text{ min}}{60 \text{ sec}}\right) = \boxed{25\pi \text{ ft/sec}}$

(30) graphs intersect at $(1,0)$ and $(\frac{1}{2}, -\frac{1}{2})$.

C $\quad m = \dfrac{-\frac{1}{2} - 0}{\frac{1}{2} - 1} = \boxed{1}$