

Section 12.6

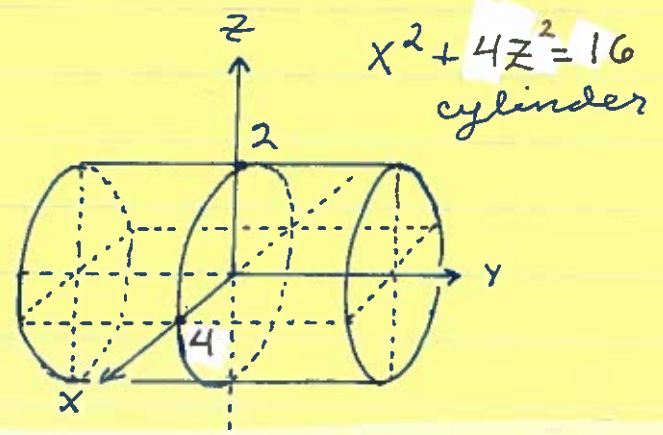
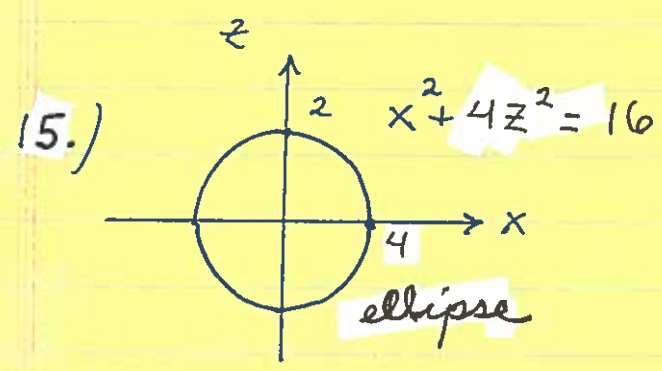
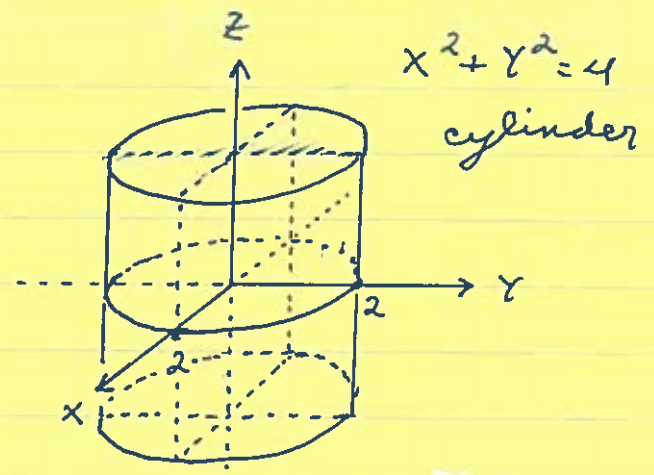
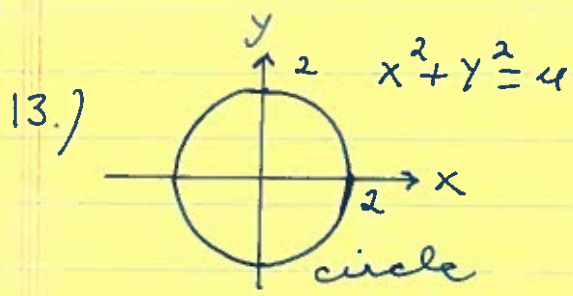
1.) d.) ellipsoid

4.) g.) double cone

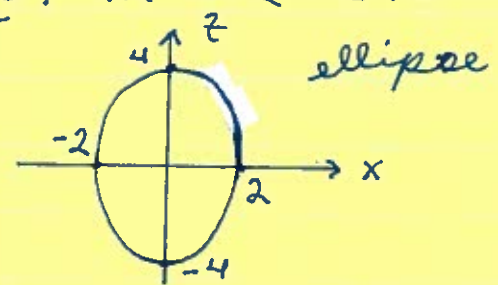
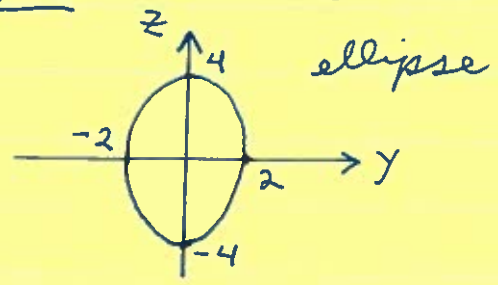
6.) e.) paraboloid

7.) b.) elliptical cylinder

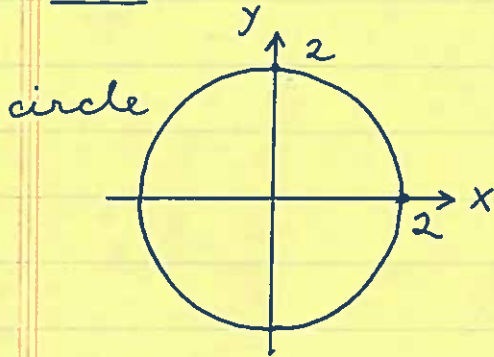
11.) h.) double cone



18.) $4x^2 + 4y^2 + z^2 = 16$: Intercepts :
 $x=0, y=0 \rightarrow z = \pm 4$; $x=0, z=0 \rightarrow y = \pm 2$;
 $y=0, z=0 \rightarrow x = \pm 2$; Traces :
 $x=0$: $4y^2 + z^2 = 16$; $y=0$: $4x^2 + z^2 = 16$



$$z=0: x^2 + y^2 = 4$$



Level Curves

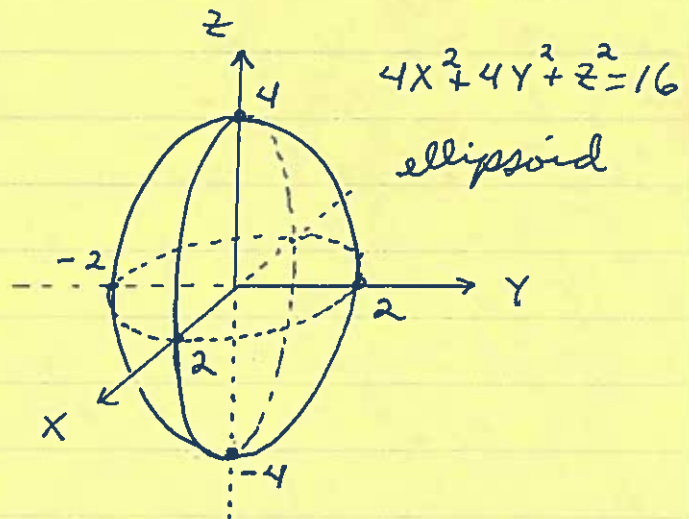
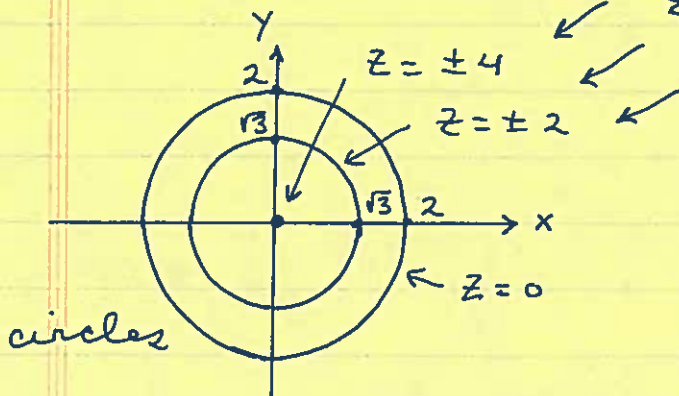
$$z=-4: x^2 + y^2 = 0 \rightarrow x=0, y=0$$

$$z=-2: x^2 + y^2 = 3$$

$$z=0: x^2 + y^2 = 4$$

$$z=2: x^2 + y^2 = 3$$

$$z=4: x^2 + y^2 = 0 \rightarrow x=0, y=0$$



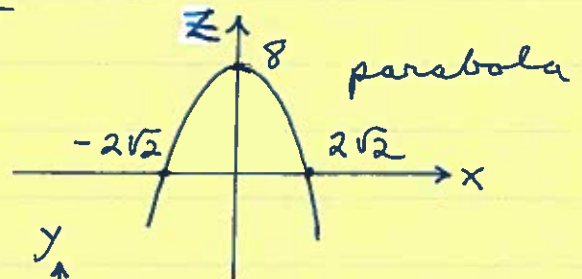
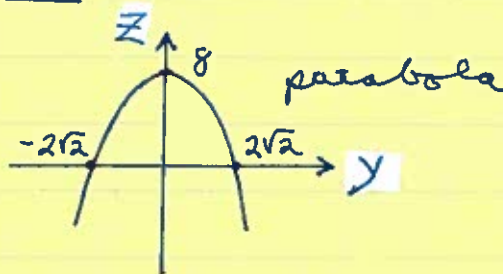
22.) $z = 8 - x^2 - y^2$: Intercepts :

$$x=0, y=0 \rightarrow z=8 ; x=0, z=0 \rightarrow y = \pm 2\sqrt{2} ;$$

$$y=0, z=0 \rightarrow x = \pm 2\sqrt{2} ;$$

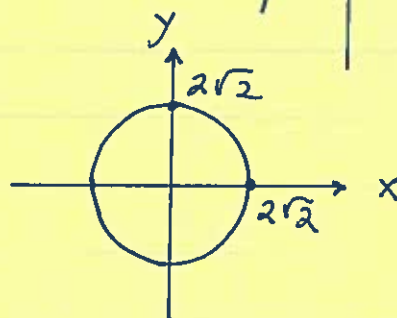
$x=0$: $z = 8 - y^2$

$y=0$: $z = 8 - x^2$



$z=0$: $x^2 + y^2 = 8$

circle



Level Curves

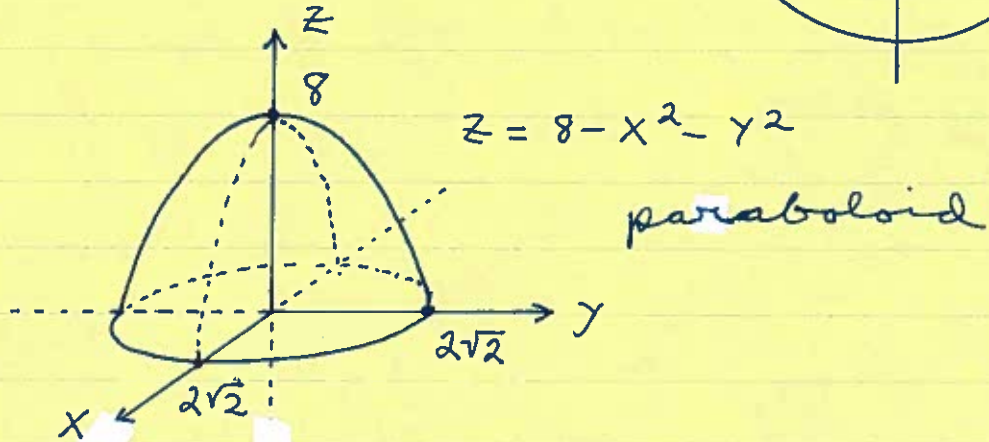
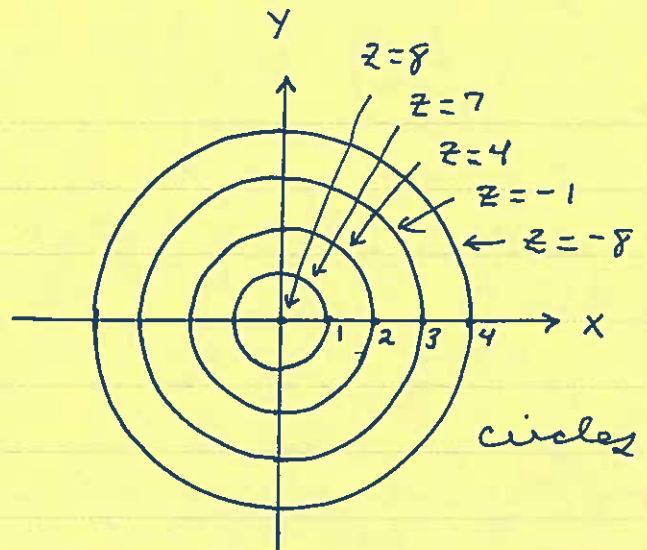
$$z=8: x^2 + y^2 = 0 \rightarrow x=0, y=0$$

$$z=7: x^2 + y^2 = 1$$

$$z=4: x^2 + y^2 = 4$$

$$z=-1: x^2 + y^2 = 9$$

$$z=-8: x^2 + y^2 = 16$$



25.) $x^2 + y^2 = z^2$:

Intercepts:

$$x=0, y=0 \rightarrow z=0$$

$$x=0, z=0 \rightarrow y=0$$

$$y=0, z=0 \rightarrow x=0$$

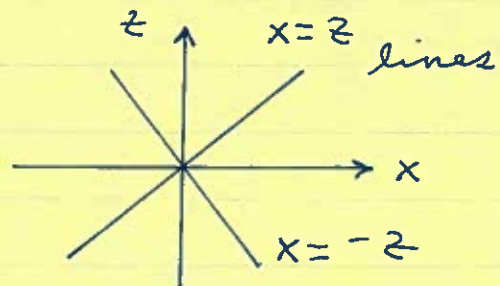
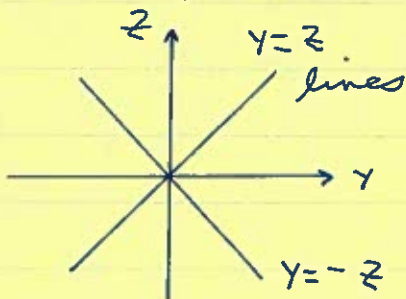
Traces:

$$\underline{x=0}: y^2 = z^2$$

$$\underline{y=0}: x^2 = z^2 \rightarrow$$

$$\rightarrow y = \pm z$$

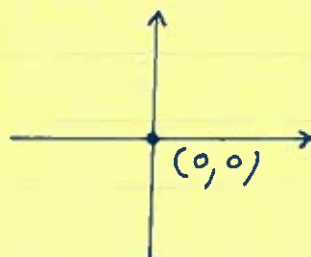
$$x = \pm z$$



$$\underline{z=0}: x^2 + y^2 = 0$$

$$\rightarrow x=0, y=0$$

point



Level Curves

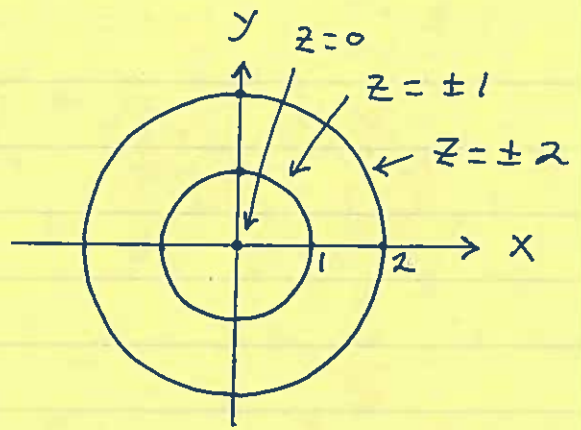
$$z = -2 : x^2 + y^2 = 4$$

$$z = -1 : x^2 + y^2 = 1$$

$$z = 0 : x^2 + y^2 = 0 \rightarrow x=0, y=0$$

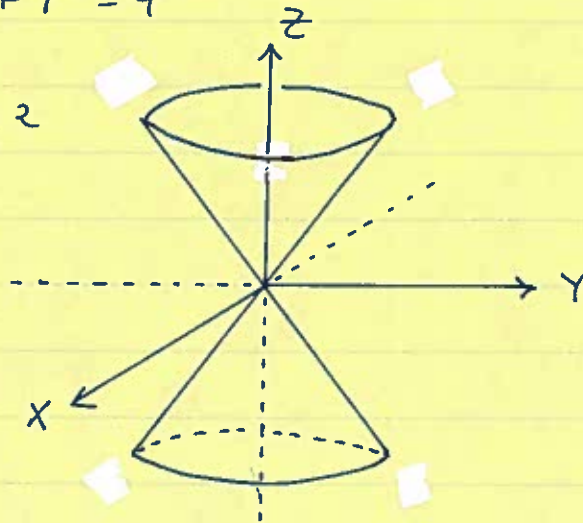
$$z = 1 : x^2 + y^2 = 1$$

$$z = 2 : x^2 + y^2 = 4$$



$$x^2 + y^2 = z^2$$

two
cones

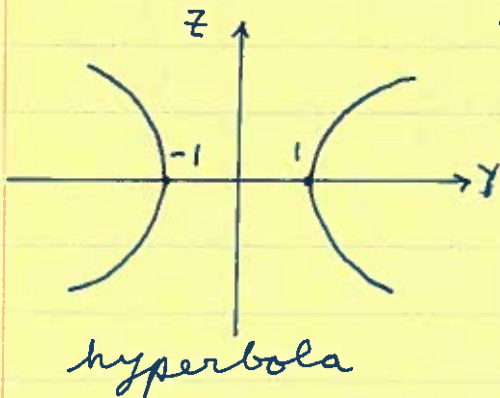


27.) $x^2 + y^2 = z^2 + 1$: Intercepts :

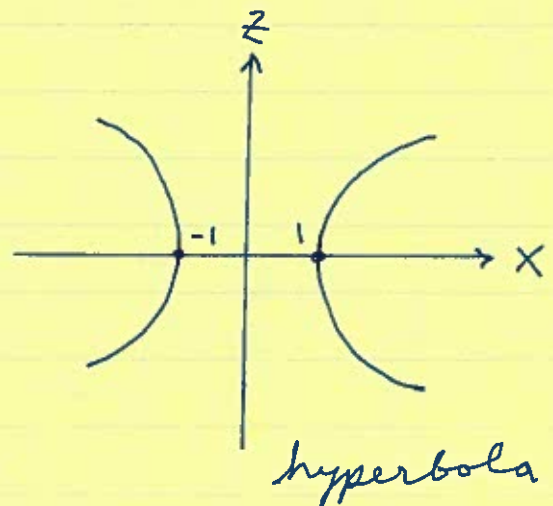
$$x=0, y=0 \rightarrow z^2 + 1 = 0 \text{ (impossible!)} ;$$

$$x=0, z=0 \rightarrow y = \pm 1 ; y=0, z=0 \rightarrow x = \pm 1 ;$$

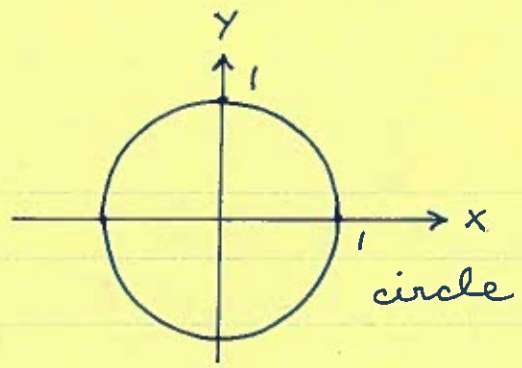
Traces : $x=0$: $y^2 - z^2 = 1$



$y=0$: $x^2 - z^2 = 1$



$$z=0: x^2+y^2=1$$



Level Curves:

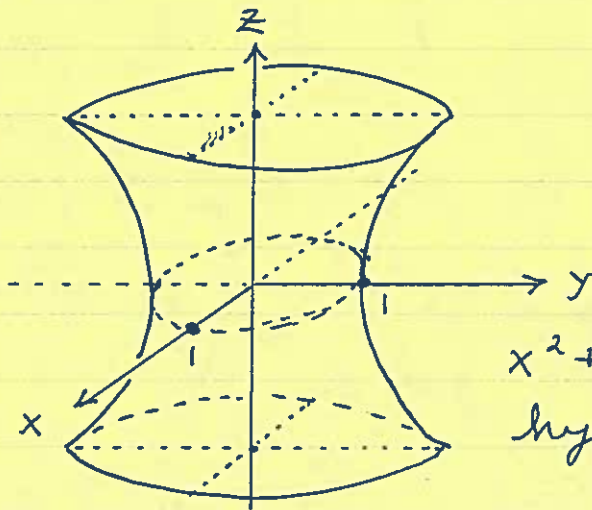
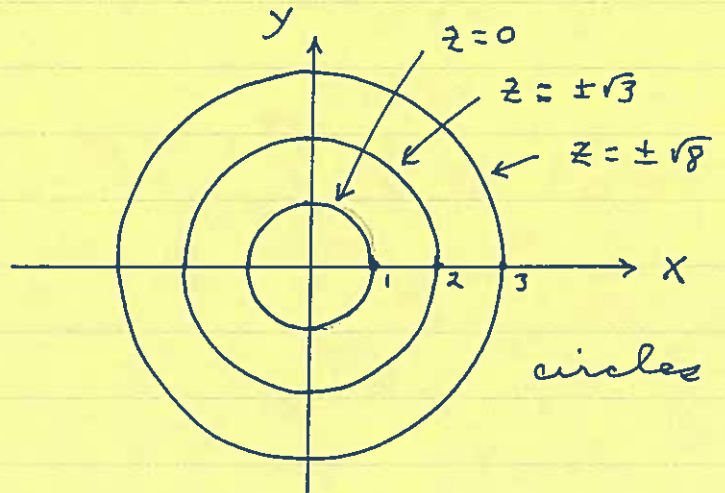
$$z=-\sqrt{8}: x^2+y^2=9$$

$$z=-\sqrt{3}: x^2+y^2=4$$

$$z=0: x^2+y^2=1$$

$$z=\sqrt{3}: x^2+y^2=4$$

$$z=\sqrt{8}: x^2+y^2=9$$



$$x^2+y^2=z^2+1$$

hyperboloid
of one sheet

$$29.) z^2 - x^2 - y^2 = 1 \rightarrow x^2 + y^2 = z^2 - 1$$

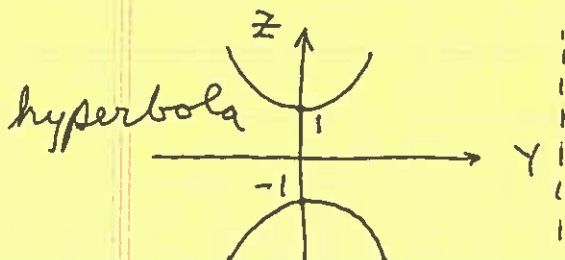
Intercepts: $x=0, y=0 \rightarrow 0 = z^2 - 1 \rightarrow$

$$z^2 = 1 \rightarrow z = \pm 1$$

$$x=0, z=0 \rightarrow y^2 = -1 \text{ (impossible)};$$

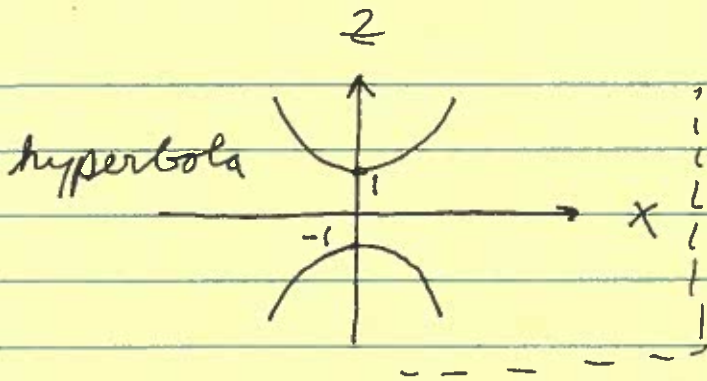
$$y=0, z=0 \rightarrow x^2 = -1 \text{ (impossible)};$$

Traces: $x=0: y^2 = z^2 - 1 \rightarrow z^2 - y^2 = 1$



$$y=0: x^2 = z^2 - 1 \rightarrow$$

$$z^2 - x^2 = 1$$



$z=0: x^2+y^2=-1$
(impossible)

Level Curves

$z=1: x^2+y^2=0 \rightarrow x=0, y=0$

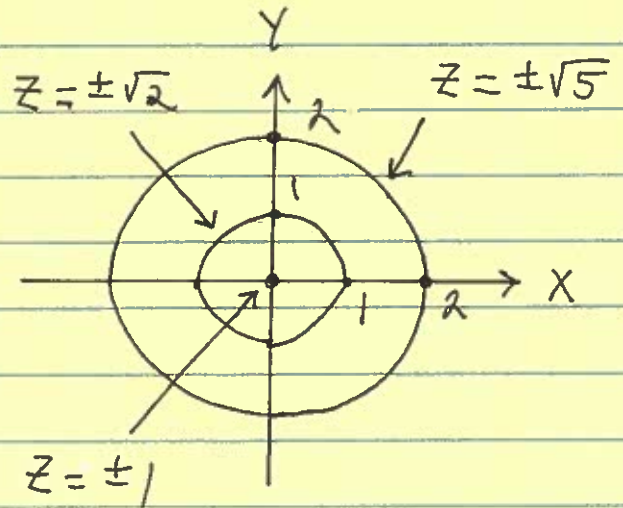
$z=-1: x^2+y^2=0 \rightarrow x=0, y=0$

$z=\sqrt{2}: x^2+y^2=1$

$z=-\sqrt{2}: x^2+y^2=1$

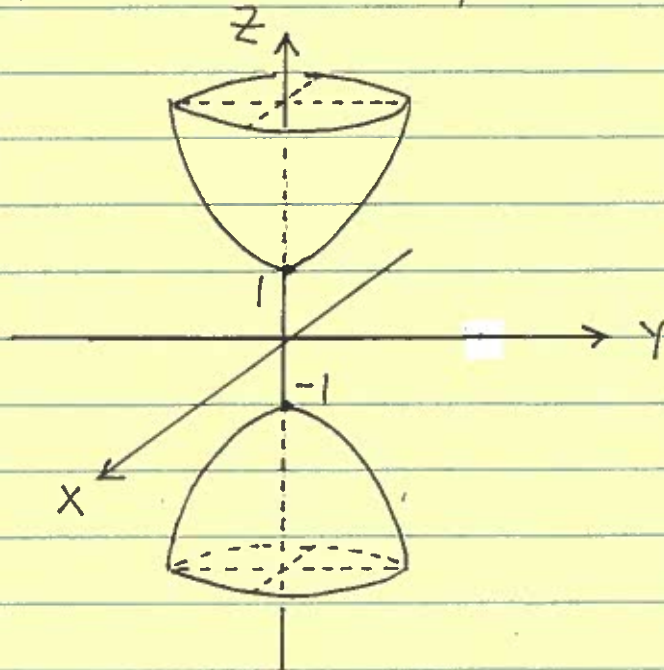
$z=\sqrt{5}: x^2+y^2=4$

$z=-\sqrt{5}: x^2+y^2=4$



$x^2+y^2 = z^2 - 1$

hyperboloid
of two
sheets



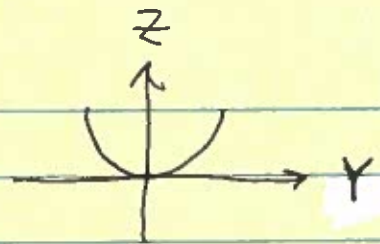
31.) $z = y^2 - x^2$

Intercepts: $x=0, y=0 \rightarrow z=0;$

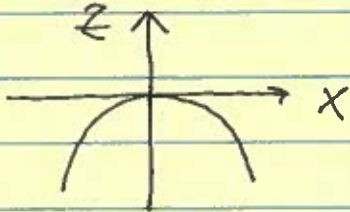
$x=0, z=0 \rightarrow y=0;$

$y=0, z=0 \rightarrow x=0;$

Traces : $x=0$: $z=y^2$

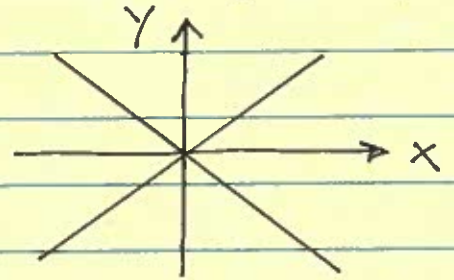


$y=0$: $z=-x^2$



$z=0$: $0 = y^2 - x^2 = (y-x)(y+x)$

$\rightarrow y=x$
or $y=-x$



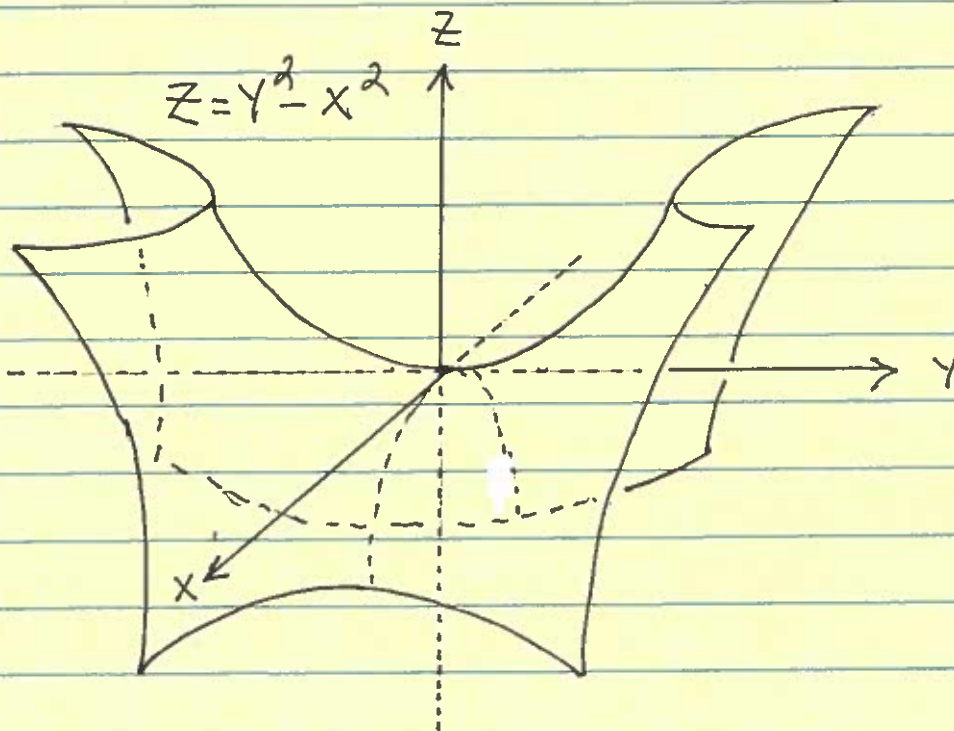
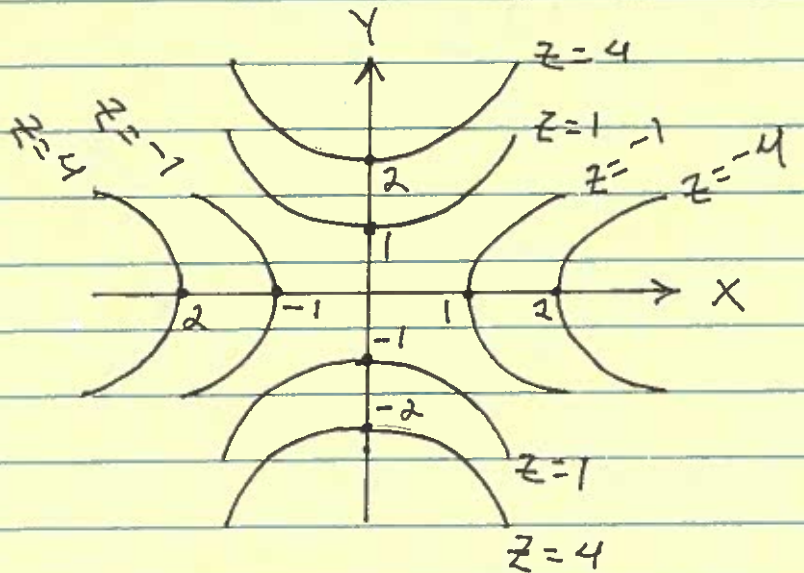
Level Curves

$z=1$: $y^2 - x^2 = 1$

$z=-1$: $x^2 - y^2 = 1$

$z=4$: $y^2 - x^2 = 4$

$z=-4$: $x^2 - y^2 = 4$



hyperbolic
paraboloid
(saddle)

