1.4 p.116 1-7 (odd) 11-21 (odd)

**#1** $f+g = 2x-1+x^2$
$= x^2+2x-1$
D: $(-\infty,\infty)$
$f-g = 2x-1-x^2$
$= -x^2+2x-1$
D: $(-\infty,\infty)$
$f(g) = (2x-1)(x^2)$
$= 2x^3-x^2$
D: $(-\infty,\infty)$

**#3** $f+g = \sqrt{x}+\sin x$
D: $[0,\infty)$
$f-g = \sqrt{x}-\sin x$
D: $[0,\infty)$
$fg = \sqrt{x}\sin x$
D: $[0,\infty)$

**#5** $\frac{f}{g} = \frac{\sqrt{x+3}}{x^2}$
$\sqrt{x+3} \geq 0$ $\quad x^2 \neq 0$
$x \geq -3$ $\quad x \neq 0$
$\boxed{D: [-3,0)\cup(0,\infty)}$

Notice the difference

$\frac{g}{f} = \frac{x^2}{\sqrt{x+3}}$
$\sqrt{x+3} > 0$
$x > -3$
$\boxed{D: (-3,\infty)}$

since the $\sqrt{\ }$ is in the denominator it can't $=0$.

**#7** $\frac{f}{g} = \frac{x^2}{\sqrt{1-x^2}}$

radical in denominator can't $=0$. But

$1-x^2 > 0$
$1 > x^2$
or $\sqrt{x^2} < \sqrt{1}$
$x < 1$ $\quad x > -1$ $\quad \boxed{D: (-1,1)}$

because it's now in the numerator

$\frac{g}{f} = \frac{\sqrt{1-x^2}}{x^2}$ ← do forget $x^2$ is in denominator

$1-x^2 \geq 0$ $\quad x^2 \neq 0$
$[-1,1] \longrightarrow$ $\boxed{D: [-1,0)\cup(0,1]}$

**#11** $f(x) = 2x-3$ $\quad g(x) = x+1$
$2\ x\ -3$
$(f\circ g)(3) = 2(x+1)-3$
$= 2(3)+2-3$
$= \boxed{5}$

~~$(f\circ g)($~~
$x\ +1$
$(g\circ f)(-2) = (2(-2)-3)+1$
$= -4-3+1$
$= \boxed{-6}$

**#13** $f(x) = x^2+4$ $\quad g(x) = \sqrt{x+1}$
$x^2\ +4$
$(f\circ g)(3) = (\sqrt{x+1})^2+4$
$= 3+1+4 = \boxed{8}$

$\sqrt{x\ +1}$
$(g\circ f)(-2) = \sqrt{(x^2+4)+1}$
$= \sqrt{((-2)^2+4)+1}$
$= \sqrt{9} = \boxed{3}$

#15 $f(x) = 3x + 2 \quad g(x) = x - 1$

$3\,(x)\;+2 \qquad\qquad x\;-1$

$f(g(x)) = 3(x-1) + 2 \qquad g(f(x)) = (3x+2) - 1$

$= 3x - 3 + 2 \qquad = \boxed{3x + 1}$

$= \boxed{3x - 1}$

#17 $f(x) = x^2 - 2 \quad g(x) = \sqrt{x+1}$

$f(g(x)) = (\sqrt{x+1})^2 - 2 \qquad g(f(x)) = \sqrt{(x^2-2)+1}$

$= x + 1 - 2 \qquad = \boxed{\sqrt{x^2 - 1}}$

$= \boxed{x - 1}$

#19 $f(x) = x^2 \quad g(x) = \sqrt{1 - x^2}$

$f(g(x)) = (\sqrt{1-x^2})^2 \qquad g(f(x)) = \sqrt{1-(x^2)^2}$

$= \boxed{1 - x^2} \qquad = \boxed{\sqrt{1 - x^4}}$

#21 $f(x) = \frac{1}{2x} \quad g(x) = \frac{1}{3x}$

$$f(g(x)) = \frac{1}{2\left(\frac{1}{3x}\right)} = \frac{1}{\frac{2}{3x}} = \boxed{\frac{3x}{2}}$$

$$g(f(x)) = \frac{1}{3\cancel{x}\left(\frac{1}{2x}\right)} = \frac{1}{\frac{3}{2x}} = \boxed{\frac{2x}{3}}$$

$\boxed{1.4}$ p.117 23-30,
(day 2) 37-43 (odd), 47-50, 52

#23 $y=\sqrt{(x^2-5x)}$

$f(x)=\sqrt{x}$ $g(x)=x^2-5x$

#24 $y=(x^3+1)^2$

$f(x)=x^2$ $g(x)=x^3+1$

#25 $y=|3x-2|$

$f(x)=|x|$ $g(x)=3x-2$

#26 $y=\dfrac{1}{(x^3-5x+3)}$

$f(x)=\dfrac{1}{x}$ $g(x)=x^3-5x+3$

#27 $y=(x-3)^5+2$

$f(x)=x^5+2$ $g(x)=x-3$

#28 $y=e^{(\sin x)}$

$f(x)=e^x$ $g(x)=\sin x$

#29 $y=\cos(\sqrt{x})$

$f(x)=\cos x$ $g(x)=\sqrt{x}$

#30 $y=(\tan x)^2+1$

$f(x)=x^2+1$ $g(x)=\tan x$

#37 $x^2+y^2=25$

$\quad -x^2 \qquad -x^2$

$\sqrt{y^2}=\sqrt{25-x^2}$

2 implicitly defined functions $\rightarrow$ $\boxed{y=\pm\sqrt{25-x^2}}$

$y=\sqrt{25-x^2}$ $y=-\sqrt{25-x^2}$

#39 $x^2-y^2=25$

$\sqrt{x^2-25}=\sqrt{y^2}$

$\boxed{\pm\sqrt{x^2-25}=y}$

#41 $x+|y|=1$

$|y|=1-x$

$y=(1-x)$ $y=-(1-x)$

$\boxed{y=1-x}$ $\boxed{y=-1+x}$

#43 $\sqrt{y^2}=\sqrt{x^2}$

$y=\pm x$

$\boxed{y=x}$ $\boxed{y=-x}$

#47 $\boxed{C}$ all others are always true. Think about each one.

#48 $\dfrac{f}{g}=\dfrac{x-7}{\sqrt{4-x}}$ $\boxed{A}$

$4-x>0$

$4>x$

$x<4$ $(-\infty,4)$

#49 $f(x)=x^2+1$ $\boxed{E}$

$(f\circ f)(x)=(x^2+1)^2+1$

$=x^4+2x^2+1+1$

$=x^4+2x^2+2$

#50 $\boxed{B}$ See #43

~~#52~~

#52 $f(x) = x^2 + 1$

a) $(fg)(x) = x^4 - 1 = (x^2+1)(\ ?\ )$

$$\boxed{g(x) = x^2 - 1}$$

b) $(f+g)(x) = 3x^2 = x^2 + 1 + (\ ?\ )$

$$\boxed{g(x) = 2x^2 - 1}$$

c) $\left(\frac{f}{g}\right)(x) = 1 = \frac{x^2+1}{(\ ?\ )}$

$$\boxed{g(x) = x^2 + 1}$$

d) $f(g(x)) = 9x^4 + 1 = (\ ?\ )^2 + 1$

$$\boxed{g(x) = 3x^2}$$

e) $g(f(x)) = 9x^4 + 1 = 9\left((x^2+1) - 1\right)^2 + 1$

$$\boxed{g(x) = 9(x-1)^2 + 1}$$

$=0$

so $(x^2)^2 = x^4$

then $9x^4$

then $+1$

$\boxed{1.5}$ p. 126 9-31 (odd)

#9 a) Not a function, does not pass vertical line test which means some inputs have more than 1 output.

b) The inverse is a function, passes the horizontal line test.

#11 a) is a function, every input has exactly 1 output. Passes vertical line test

b) The inverse is a function, passes horizontal line test.

#13 $f(x) = 3x - 6$

$x = 3y - 6$
$+6 \qquad +6$

$\frac{x+6}{3} = \frac{3y}{3}$

$\boxed{f^{-1}(x) = \frac{1}{3}x + 2}$

No Domain restr.

#15 $f(x) = \frac{2x-3}{x+1}$ ← vertical asymptote becomes horizontal. Not a ~~d~~ domain restriction in the inverse

$(y+1)x = \frac{2y-3}{\cancel{y+1}}\cancel{(y+1)}$

$x\cancel{y} + x = 2y - \cancel{3}$
$-\cancel{x}y + 3 \qquad -xy + \cancel{3}$

$x + 3 = 2y - xy$

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

$\boxed{f^{-1}(x) = \frac{x+3}{2-x}}$ $\boxed{D: (-\infty, 2) \cup (2, \infty)}$

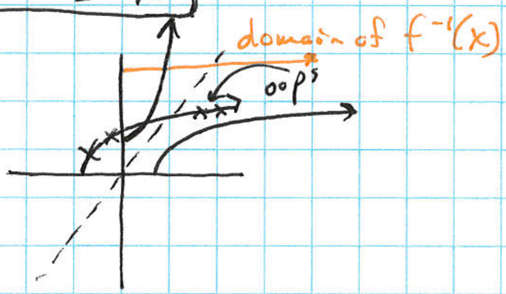
#17 $f(x) = \sqrt{x-3}$

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

$x^2 = y - 3$
$+3 \qquad +3$

$\boxed{x^2 + 3 = f^{-1}(x)}$

Range is $[0, \infty)$ so domain of inverse is $\boxed{D: [0, \infty)}$




#19 $f(x) = x^3$

$\sqrt[3]{x} = \sqrt[3]{y^3}$

$\boxed{\sqrt[3]{x} = y = f^{-1}(x)}$ $\boxed{D: (-\infty, \infty)}$

No D or R restrictions so $f^{-1}(x)$ has none

#21 $f(x) = \sqrt[3]{x+5}$

$(x)^3 = (\sqrt[3]{y+5})^3$

$x^3 = y + 5$
$-5 \qquad -5$

$\boxed{x^3 - 5 = y}$ $\boxed{D: (-\infty, \infty)}$

#23 One to one means the original relation is a function and its inverse is also a function

Yes #23 is 1-to-1.

#24 and #26 are NOT one-to-one look at those!

#25 is one-to-one

#27 $f(x) = 3x - 2 \qquad g(x) = \frac{x+2}{3}$

$$f(g(x)) = \cancel{3}\left(\frac{x+2}{\cancel{3}}\right) - 2 = x \cancel{+2} \cancel{-2} = x \qquad g(f(x)) = \frac{3x \cancel{-2} \cancel{+2}}{3} = \frac{\cancel{3}x}{\cancel{3}} = x$$

Inverses!

#29 $f(x) = x^3 + 1 \qquad g(x) = \sqrt[3]{x-1}$

$$f(g(x)) = (\cancel{\sqrt[3]{}}x-1)^{\cancel{3}} + 1 = x \cancel{-1} \cancel{+1} = x \qquad g(f(x)) = \sqrt[3]{x^3 \cancel{+1} \cancel{-1}} = \sqrt[\cancel{3}]{x^{\cancel{3}}} = x$$

Inverses!

#31 $f(x) = \frac{x+1}{x} \qquad g(x) = \frac{1}{x-1}$

$$f(g(x)) = \frac{\frac{1}{x-1} + 1\frac{(x-1)}{(x-1)}}{\frac{1}{x-1}}$$ ← common denominator to add fractions

$$= \frac{\frac{\cancel{1} + x \cancel{-1}}{x-1}}{\frac{1}{x-1}} = \frac{x}{\cancel{(x-1)}} \cdot \frac{\cancel{(x-1)}}{1} = x$$

copy dot flip

$$g(f(x)) = \frac{1}{\frac{x+1}{x} - 1\frac{x}{x}} = \frac{1}{\frac{x+1-x}{x}} = \frac{1}{\frac{1}{x}} = 1 \cdot \frac{x}{1} = x$$

common denominator

copy dot flip

Inverses!

(day 1)

$\boxed{1.6}$ p. 136 1-23 (odd)

#1 It's a quadratic function shifted down 3 units.

$$y = x^2 - 3$$

#3 A quadratic function shifted left 4 units.

$$y = (x+4)^2$$

#5 Another quadratic function reflected horizontally then shifted right 100 units.

$$y = (100-x)^2$$
$$y = (-x+100)^2$$
$$y = (-(x-100))^2$$

#7 yet again, a quadratic shifted right 1 and up 3.

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

#9 Ah, a square root! reflected vertically

$$y = -\sqrt{x}$$

#11 A square root function reflected horizontally

$$y = \sqrt{-x}$$

#13 Ooh now a cubic! Vertically stretched by a factor of 2

$$y = 2x^3$$

#15 A cubic horizontally stretched by a factor of 5

$$y = (0.2x)^2 = \left(\tfrac{1}{5}x\right)^2$$ inverse of $\frac{1}{5}$ is 5

#17 $f(x) = \sqrt{x+2}$ to $g(x) = \sqrt{x-4}$

Shift $f(x)$ to the right 6 units

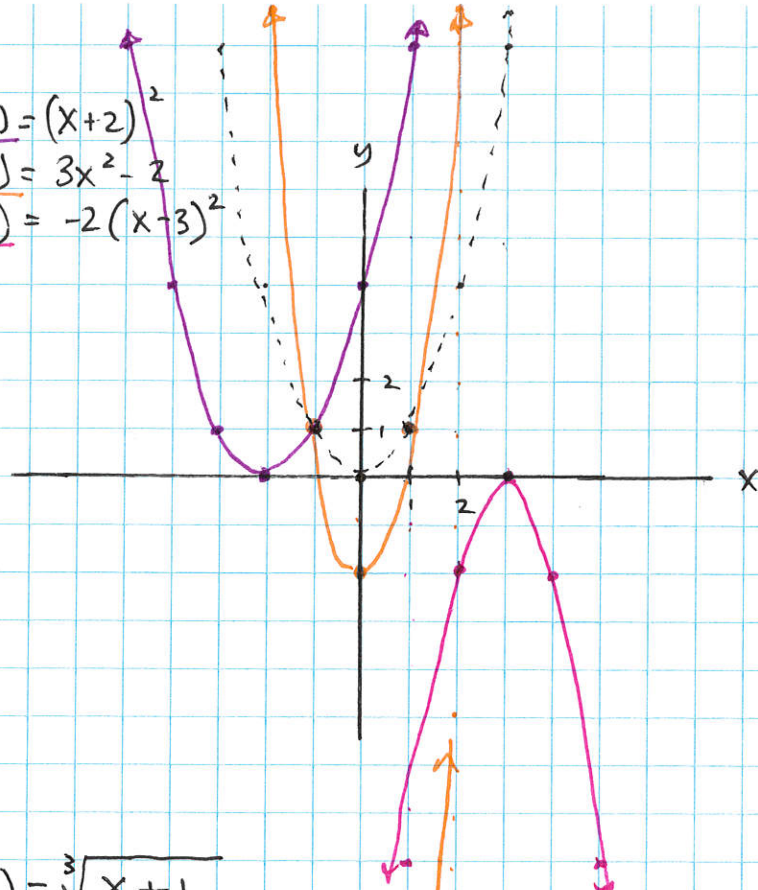
#19 $f(x) = (x-2)^3$ to $g(x) = -(x+2)^3$

reflect $f(x)$ vertically then shift to the left 4 units

(#21) $f(x) = (x+2)^2$

$g(x) = 3x^2 - 2$

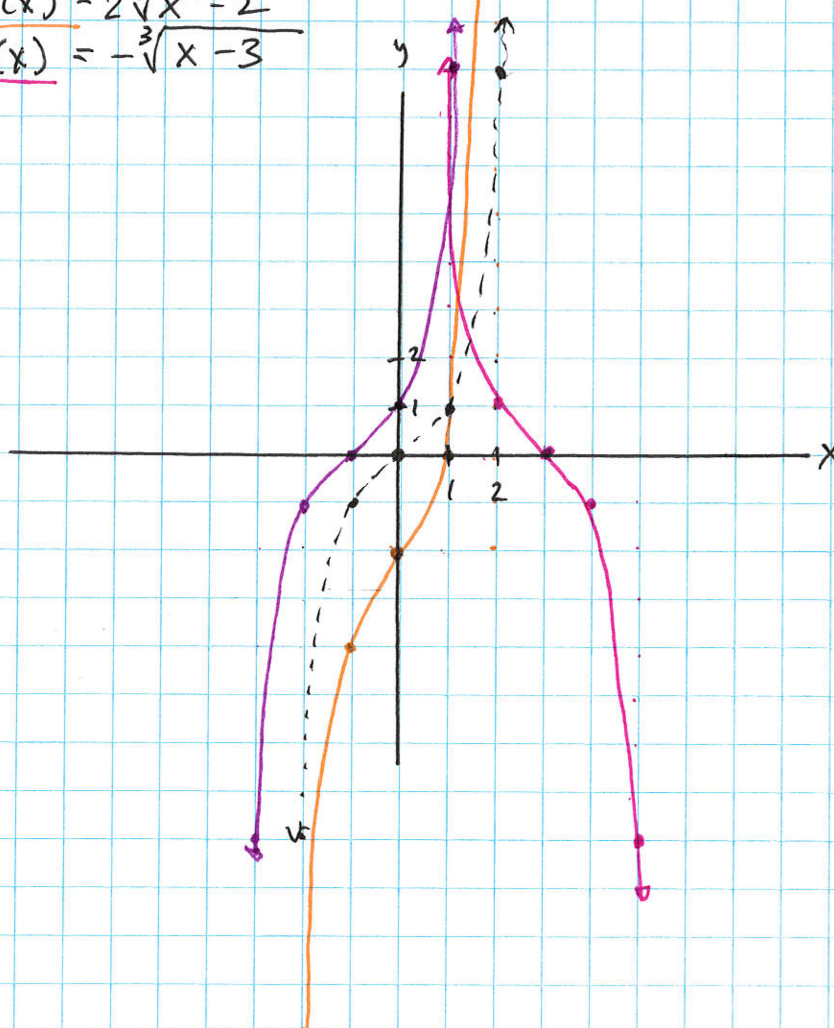
$h(x) = -2(x-3)^2$




(#23) $f(x) = \sqrt[3]{x+1}$

$g(x) = 2\sqrt[3]{x} - 2$

$h(x) = -\sqrt[3]{x-3}$

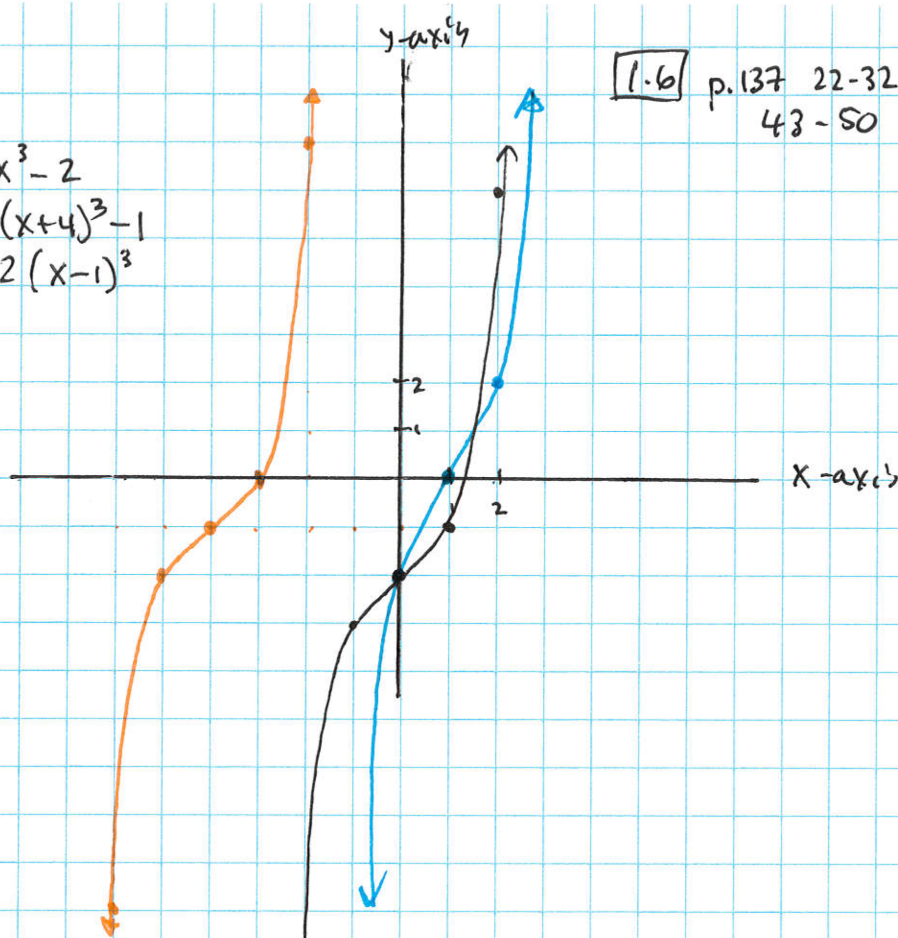


$\boxed{1.6}$ p. 137 22-32 (even) 43-50

#22 $f(x) = x^3 - 2$

$g(x) = (x+4)^3 - 1$

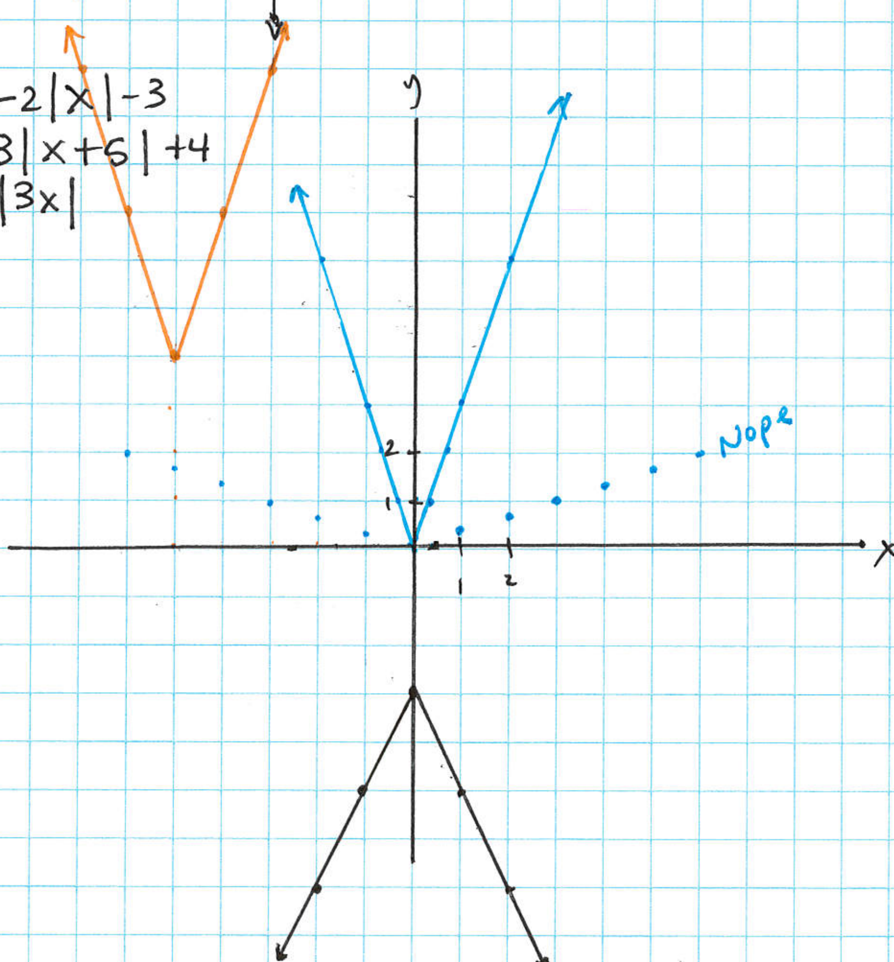
$h(x) = 2(x-1)^3$




#24 $f(x) = -2|x| - 3$

$g(x) = 3|x+5| + 4$

$h(x) = |3x|$



#26 $f = \sqrt{-(x-3)}$

#28 $f = 2\sqrt{x+5} - 3$

#30 $f(x) = 2\sqrt{x+3} - 4$

a) $f(x) = -2\sqrt{x+3} + 4$

b) $f(x) = 2\sqrt{-x+3} - 4$

#32 $f(x) = 3|x+5|$

a) $f(x) = -3|x+5|$

b) $f(x) = 3|-x+5|$

#43 $y = 2(x-3)^2 - 4$

- Vertical stretch by a factor of 2
- Shift right 3 units
- Shift down 4 units

#44 $y = -3\sqrt{x+1}$

- Vertical reflection
- Vertical stretch by a factor of 3
- Shift left 1 unit

#45 $y = (3x)^2 - 4$

- Horizontal shrink by a factor of $\frac{1}{3}$
- Shift down 4 units

#46 $y = -2|x+4| + 1$

- Vertical reflection
- Vertical stretch by a factor of 2
- Shift right 4 units and up 1 unit

#47 $y = 3(x-4)^2$

#48 $y = 3(x-4)^2$

#49 $y = 2|x+2| - 4$

#50 $y = |2(x+2)| - 4$

---

$\boxed{1.7}$ p. 148 2–14 even
22, 27, 33, 36

#2 $3(x+5)$

#4 $0.05x + 4$

#6 $A = \frac{1}{2}x(x-2)$

#8 $I = .97x$

#10 $C = 1.0875x$

#12 $C = (28000)(.09) + 28,000 + 19.85x$
$= 28,000(1.09) + 19.85x$

#14 $P = 200,000 + 0.12x$

#22 $x + 2x + 3x = 714$

$\frac{6x}{6} = \frac{714}{6}$

$x = 119$

then 238

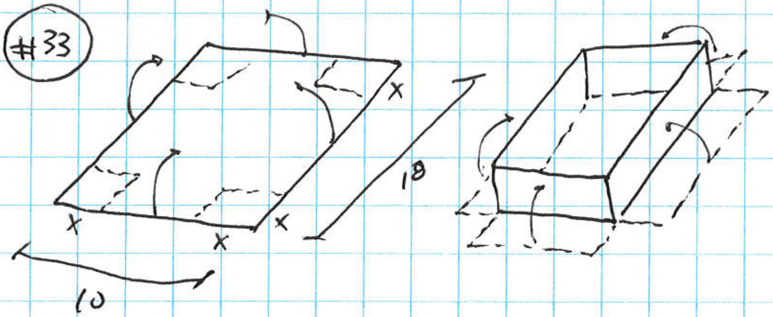
then 357

#27

$33(.60) = 19.8$ $\quad$ $27(.75) = 20.25$

orange and black
obviously for us

#33

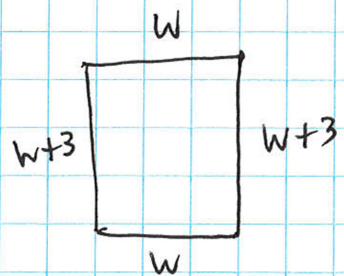



a) $V = x(10-2x)(18-2x)$

b) D: $(0,5)$ cutting 0 inches won't make a box
cutting ~~more~~ 5 or more would cut
of the entire short side ~~side~~ since the
short side is only 10 inches.

c) A 2.063 x 2.063 square should be cut
for a maximum volume of 168.126 inches$^3$

#36




$P = 2w + 2(w+3)$

$54 = 2w + 2w + 6$

$\quad = 4w + 6$

$-6 \qquad -6$

$\dfrac{48}{4} = \dfrac{4w}{4}$

$12 = w$

$15 = l$

The width is 12 feet and
length is 15 feet.