p.452-454
1, 4-7, 9, 10, 14, 15, 19, 23-25, 28, 29, 35, 47

11.3

1.) $y = x^3 + 7x^2 + 12x$

$y = x(x^2 + 7x + 12)$

$y = x(x+3)(x+4)$

$0 = x(x+3)(x+4)$

$\boxed{x=0 \quad x=-3 \quad x=-4}$

4.) $y = a(x+2)(x-b)$ a & b are constants

$0 = a(x+2)(x-b)$

$\boxed{x=-2 \quad x=b}$

Do not worry about "K" value in these problems.

5.) Zeros at $x = -2, 0, 3$

$x(x+2)(x-3)$

Double zero at $x=-2$ as it bounces off and doesn't cross x-axis.

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

6.) zeros at $-2, 0, 2, 4$

$x(x+2)(x-2)(x-4)$

$\boxed{g(x) = x(x+2)(x-2)(x-4)}$

No double zeros

7.) Zeros at $-2, 2$

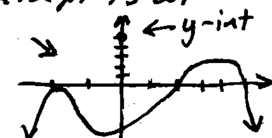
$(x+2)(x-2)$

Triple zero at $x=2$ since graph is flatter or lingers there.

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

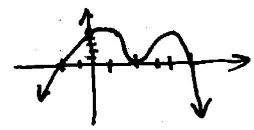
9.) Find possible formula for polynomial with zeros at $x=-2, 2, 5$. A y-intercept of $y=5$ and long-run behavior $y \to -\infty$ as $x \to \pm\infty$

Must be even-powered degree, since $y \to -\infty$ as $x \to \pm\infty$. So if it is 4th degree, it must have a double-zero somewhere. Since the y-intercept is at $(0,5)$, the double-zero can't be at $x=-2$.



Therefore, the double zero could be at $x=2$

$y = K(x+2)(x-2)^2(x-5)$



$5 = K(0+2)(0-2)^2(0-5)$

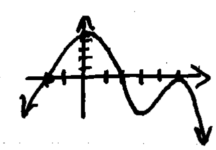
$5 = -40K$

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

$\boxed{y = -\frac{1}{8}(x+2)(x-2)^2(x-5)}$

or at $x=5$

$y = K(x+2)(x-2)(x-5)^2$



$5 = K(0+2)(0-2)(0-5)^2$

$5 = -100K$

$-\frac{1}{20} = K$

$\boxed{y = -\frac{1}{20}(x+2)(x-2)(x-5)^2}$

10.) $f(x) = -5(x^2-4)(25-x^2)$

$f(x) = -5(x+2)(x-2)(5+x)(5-x)$

x-intercepts: $x = -2, 2, 5, -5$

$f(0) = -5(0^2-4)(25-0^2) = -5(-4)(25) = 500$ ← y-intercept

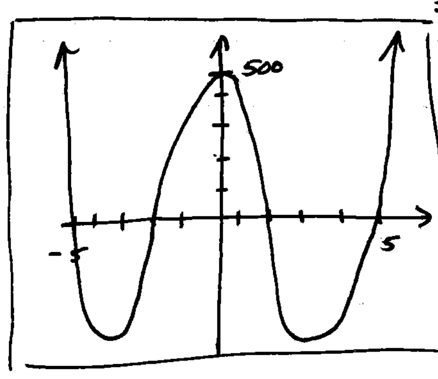
Opens upward because: $-5(x^2-4)(25-x^2)$

$= (-5x^2+20)(25-x^2)$

$= -125x^2 + 5x^4 + 500 - 20x^2$

$= 5x^4 - 145x^2 + 500$

↑



14.) $p(x)=x^4+10x^3-68x^2+102x-45$

Zeros at $x=-15$ $x=1$ (bounces) and $x=3$

so $p(x)=K(x+15)(x-1)^2(x-3)$

Since $a=1$ in non-factored, $K=1$

$\boxed{p(x)=(x+15)(x-1)^2(x-3)}$

15.) 4th degree opens downward, so lead coefficient must be negative with y-intercept of -6.

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

$y=-\frac{1}{2}(0+2)(0+1)(0-2)(0-3)$

$y=-\frac{1}{2}(12)=-6$

19.) 3rd degree $f(-3)=0$ $f(1)=0$ $f(4)=0$ $f(2)=5$

$f(x)=K(x+3)(x-1)(x-4)$

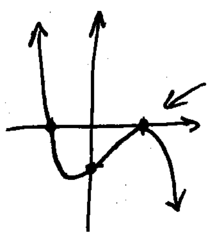
$5=K(2+3)(2-1)(2-4)$

$5=-10K$

$-\frac{1}{2}=K$

$\boxed{f(x)=-\frac{1}{2}(x+3)(x-1)(x-4)}$

23.)



Zeros $x=-1$ $x=1$

$f(x)=k(x+1)(x-1)^2$

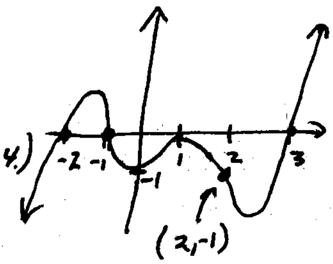
y-int → $-1=K(0+1)(0-1)^2$

$-1=K(1)$

$-1=K$

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

24.)



Zeros: $x=-2$ $x=-1$ $x=1$ (double) $x=3$

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

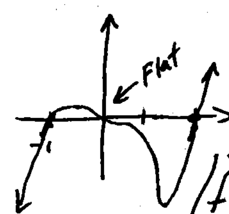
$-1=K(2+2)(2+1)(2-1)^2(2-3)$

$-1=-12K$

$\frac{1}{12}=K$

$\boxed{h(x)=-\frac{1}{12}(x+2)(x+1)(x-1)^2(x-3)}$

25.)

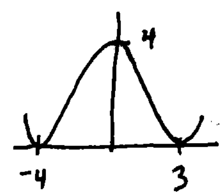


Zeros: $x=-1$ $x=0$ $x=2$

↑ Multiple

$\boxed{f(x)=Kx^3(x+1)(x-2) \quad K>0}$

28.)



Zeros: $x=-4$ $x=3$ (Both Double)

$f(x)=K(x+4)^2(x-3)^2$

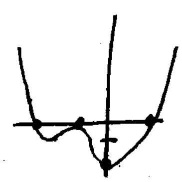
$4=K(0+4)^2(0-3)^2$

$4=144K$

$\frac{1}{36}=K$

$\boxed{f(x)=\frac{1}{36}(x+4)^2(x-3)^2}$

29.)



Zeros: $x=-2$ $x=-1$ (double) $x=1$

y-int: $(0,-2)$

$h(x)=K(x+2)(x+1)^2(x-1)$

$-2=K(0+2)(0+1)^2(0-1)$

$-2=-2K$

$1=K$

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

35.) $y=(x^2-8x+12)(x-3)$

$0=(x-6)(x-2)(x-3)$

$\boxed{x=6 \quad x=2 \quad x=3}$

47.) a.) f has zeros at $x=-2$ $x=3$ $x=5$ and y-intercept of 4.

$f(x) = k(x+2)(x-3)(x-5)$

$4 = k(0+2)(0-3)(0-5)$

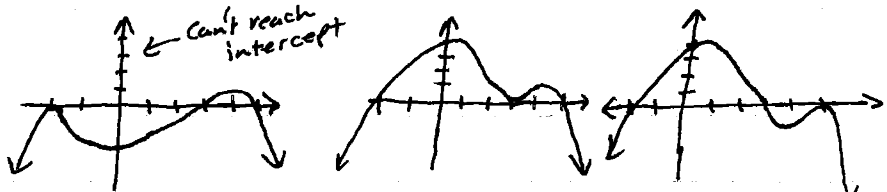
$4 = 30k$

$\frac{2}{15} = k$

$$\boxed{f(x) = \frac{2}{15}(x+2)(x-3)(x-5)}$$

b.) Same as above, but as $x \to \pm\infty$, $y \to -\infty$

Could have a double zero at $x=3$ or $x=5$ but not $x=-2$.



$x=-2$ $\quad$ $x=3$ $\quad$ $x=5$

So: $f(x) = k(x+2)(x-3)^2(x-5)$ $\quad$ or $\quad$ $f(x) = k(x+2)(x-3)(x-5)^2$

$4 = k(0+2)(0-3)^2(0-5)$ $\quad$ $4 = k(0+2)(0-3)(0-5)^2$

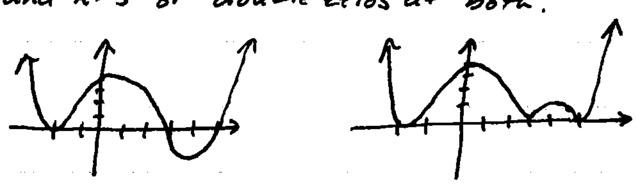
$4 = -90k$ $\quad$ $4 = 150k$

$-\frac{2}{45} = k$ $\quad$ $-\frac{2}{75} = k$

$$\boxed{f(x) = -\frac{2}{45}(x+2)(x-3)^2(x-5) \quad \text{or} \quad f(x) = -\frac{2}{75}(x+2)(x-3)^2(x-5)}$$

c) Same as a, but as $x \to \pm\infty$, $y \to \infty$.

Must have a double zero at $x=-2$ to reach y-intercept of 4. Could have single zeros at $x=3$ and $x=5$ or double zeros at both:



$f(x) = k(x+2)^2(x-3)(x-5)$ $\quad$ or $\quad$ $f(x) = k(x+2)^2(x-3)^2(x-5)^2$

$4 = k(0+2)^2(0-3)(0-5)$ $\quad$ $4 = k(0+2)^2(0-3)^2(0-5)^2$

$4 = 60k$ $\quad$ $4 = 900k$

$\frac{1}{15} = k$ $\quad$ $\frac{1}{225} = k$

$$\boxed{y = \frac{1}{5}(x+2)^2(x-3)(x-5) \quad \text{or} \quad y = \frac{1}{225}(x+2)^2(x-3)^2(x-5)^2}$$