⑯ $5x - 2y = -36 \xrightarrow{\text{multiply all terms by 3}}$ $\rightarrow$ $15x - 6y = -108$ then eliminate

$4x + 3y = -15 \longrightarrow$ multiply by 2 $\rightarrow +$ $8x + 6y = -30$

$23x = -138$

$x = -6$

$4(-6) + 3y = -15$

$-24 + 3y = -15$

$3y = 9$

$y = 3$

intersection is at $(-6, 3)$

---

⑰ 3, 6, 12, ... a) geometric since there is a constant multiplier of 2

b) $t_n = 3(2)^{n-1}$ or $t_n = \frac{3}{2}(2)^n$

---

⑱ 148, 144, 140, 136, 132, 128

$t_n = 148 - 4(n-1)$ which is same as $t_n = -4n + 152$

$t_{225} = 148 - 4(225-1) = -748$

---

⑲ expon functions

Geometric

x	y
0	3.1
1	4.34
2	6.076
3	8.5064
4	11.90896

$y = 3.1(1.4)^x$

x	y
0	3
1	18
2	108
3	648
4	3888

$\times b$

$\times b$

$3 \cdot b \cdot b = 108$

$3 \cdot b^2 = 108$

$b^2 = 36$

$b = 6$

$y = 3(6)^x$

---

⑳ $y = 2254000(1.035)^{15} = 3,776,236.265$

$\approx$ 3,776,000 people

㉑ $100\% - 12\% = 88\%$

multiplier is 0.88

ⓐ $y = 9000(0.88)^5 = \$4,749.59$ value in 5 yrs.

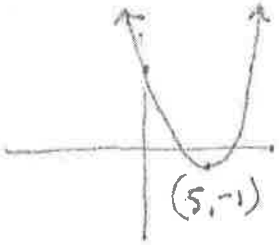
ⓑ $y = 9000(.88)^{-3} = \$13,206.71$ value 3 years ago

$y = (x-5)^2 - 1$

(22) vertex is $(5,-1)$ because

replace x with $x-5$ in any function shifts a graph 5 units to the right

Attaching a -1 to the end of any function shifts it down 1 unit



This vertex is a <u>minimum</u> because the "a" coefficient is positive so the parabola has a positive orientation.

---

(23) $y = \frac{1}{4}(x+2)(x-6)$

(a) It is easier to find the x-intercepts since the parabola function is in factored form. In other words, its easy to set equal to 0 and use the zero product property to quickly solve for x.

b) $\frac{1}{4}(x+2)(x-6) = 0$

$x+2=0$ $\quad$ $x-6=0$

$x=-2$ $\quad$ $x=6$

so the x-intercepts are $(-2,0)$ and $(6,0)$

(24a) $y = x^2 + 8x + 20$

$y = x^2 + 8x \quad + 20$

Add $\left(\frac{8}{2}\right)^2 = 16$ to complete the square

$y + 16 = \underbrace{x^2 + 8x + 16} \quad + 20$

$y + 16 = (x+4)^2 + 20$

$-16 \qquad -16$

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

so the vertex is $(-4,4)$

(24b) $y = 2x^2 + 8x - 24$

divide by 2

$\frac{y}{2} = x^2 + 4x \quad -12$

$\frac{y}{2} + 4 = \underbrace{x^2 + 4x + 4} \quad -12$

$\frac{y}{2} + 4 = (x+2)^2 - 12$

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

$y = 2(x+2)^2 - 32$

so the vertex is $(-2,-32)$

$\boxed{13b}$ $x^2+4x-3=0$

can use quadratic formula
(can't be factored)

$a=1$ $b=4$ $c=-3$

$$x=\frac{-(4)\pm\sqrt{(4)^2-4(1)(-3)}}{2(1)}$$

$$=\frac{-4\pm\sqrt{28}}{2}=\frac{-4\pm2\sqrt{7}}{2}=-\frac{4}{2}\pm\frac{2\sqrt{7}}{2}=\boxed{-2\pm\sqrt{7}}$$

$\boxed{13c}$ $8x^3-20x^2-12x=0$

can't use the quadratic formula since the equation is a cubic

but $4x$ can be factored out

$$4x(2x^2-5x-3)=0$$

Use ZPP

$4x=0$

$2x^2-5x-3=0$

Now you can use the quadratic formula or factor

$$(2x-1)(x+3)=0$$

$2x-1=0$ $x+3=0$

$$\boxed{x=0 \qquad x=\tfrac{1}{2} \qquad x=-3}$$

(26) a) $(2x)^4$

$= 2^2x^4$

$= \underline{\underline{16x^4}}$

b) $(-5xy^2)^3$

$= (-5)^3x^3(y^2)^3$

$= \underline{-125x^3y^6}$

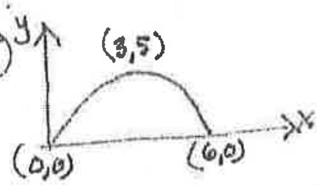
c) $\frac{4x^{512}}{x^{502}}$

$= \underline{\underline{4x^{10}}}$

d) $(6x^4y^{12})(2x^2y^5)$

$= \underline{\underline{12x^6y^{17}}}$

(25)



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

Use (6,0) to help find "a"

$0 = a(6-3)^2 + 5 \longrightarrow 0 = 9a + 5 \longrightarrow 9a = -5 \quad a = -\frac{5}{9}$

$\underline{\underline{y = -\frac{5}{9}(x-3)^2+5}}$

---

(27) $\left[\left(\frac{1}{4}\right)^{\frac{1}{2}}\right]^{-2} \longrightarrow \left[\left(\frac{1}{4}\right)^{-1}\right] \rightsquigarrow \left(\frac{4}{1}\right)^1 \longrightarrow \underline{\underline{4}}$

---

(28) a) $\frac{1}{(2x)^{-2}} = \frac{(2x)^2}{1} = 4x^2$ $\underline{\underline{\text{yes}}}$

b) $\frac{1}{2x^{-2}} = \frac{x^2}{2}$ NO

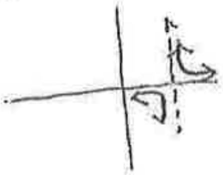
c) $\sqrt{16x^4} = \sqrt{16}\cdot\sqrt{x^4} = 4x^2$ $\underline{\underline{\text{yes}}}$

d) $\frac{{}^{4}\cancel{12}\cancel{x^{3}}x^{2}}{{}_{1}\cancel{3}\cancel{x^{3}}{}_{1}} = \underline{\underline{4x^2}}$ yes

e) $\frac{-2}{(2x^2)^{-1}} = \frac{-2(2x^2)^1}{1} = -2\cdot2\cdot x^2$

$= -4x^2$ $\underline{\text{No}}$

(29) $f(x) = \frac{2}{x-3}$



domain

$-\infty < x < \infty,\ x \neq 3$

range

$-\infty < y < \infty,\ y \neq 0$

asymptote equations

Vertical $x = 3$

horizontal $y = 0$

---

(30) $\underline{\text{x-intercepts of}}$

$3x + 5y = 18$

$3x + 5(0) = 18$

$3x = 18$

$x = 6$

$(6,0)$

$\underline{\text{y-intercept}}$

$3(0) + 5y = 18$

$5y = 18$

$y = 18/5$

$\left(0, \frac{18}{5}\right)$ or $(0, 3.6)$

$y = 2x^2 - 5x - 12$

(31) method 1: to find x-intercepts

$2x^2 - 5x - 12 = 0$

$(2x+3)(x-4) = 0$

$2x+3=0$

$x = -1.5 \qquad x=4$

$(-1.5, 0)$ and $(4,0)$

method 2 use the quadratic formula

$a=2 \quad b=-5 \quad c=-12$

$$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(-12)}}{2(2)}$$

$$x = \frac{5 \pm \sqrt{121}}{4} = \frac{5 \pm 11}{4}$$

$$x = \frac{5+11}{4} = \frac{16}{4} = 4 \qquad x = \frac{5 - 11}{4} = \frac{-6}{4} = -1.5$$

same!!

---

(32) x-intercept (set $y=0$) $\longrightarrow$ $\sqrt{x+5} = 0$ square both sides

y-intercept (set $x=0$)

$g(x) = \sqrt{x+5}$

$x+5 = 0$

$x = -5$

$(-5, 0)$

y-int

$y = \sqrt{0+5}$

$= \sqrt{5}$

$(0, \sqrt{5})$

---

(33) the center of the circle changes from $(0,0)$ to $(7,-3)$

the radius changes from 4 to 6

---

(34) New vertex is $(-3,-5)$ so the transformed equation is $y = (x+3)^2 - 5$

---

(35) $4(x-3)^2 + 5 = y$

$\qquad -5 \quad -5$

$4(x-3)^2 = y - 5$

$(x-3)^2 = \frac{y-5}{4}$

square root both sides

$$x - 3 = \pm\sqrt{\frac{y-5}{4}}$$

$$\boxed{x = \pm\sqrt{\frac{y-5}{4}} + 3}$$

which is two functions!

$\boxed{36a}$ $x - 3(y+2) = 6$
$-x \qquad\qquad -x$

$-3(y+2) = 6-x$
divide by -3

$y+2 = \frac{6}{-3} - \frac{x}{-3}$

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

$y = \frac{1}{3}x - 4$

$\boxed{36b}$ $\frac{6x-1}{y} - 3 = 2$

$\frac{6x-1}{y} = 5$
multiply by y

$6x-1 = 5y$

$y = \frac{6x-1}{5}$ or $\frac{6}{5}x - \frac{1}{5}$

$\boxed{36c}$ $x^2 + (y-3)^2 = 4$

$(y-3)^2 = 4-x^2$
$\sqrt{\ } \qquad \sqrt{\ }$

$y-3 = \pm\sqrt{4-x^2}$

$\underline{\underline{y = \pm\sqrt{4-x^2} + 3}}$

(37) $y = \sqrt{\frac{1}{2}x} + 5$
$-5 \qquad\qquad -5$

$\sqrt{\frac{1}{2}x} = y-5$ square both sides

$\frac{1}{2}x = (y-5)^2$ multiply by 2

$\underline{\underline{x = 2(y-5)^2}}$

(38a) $\frac{\cancel{4}}{\cancel{x^2}} \cdot \frac{\cancel{x^2}y}{8x^3} \cdot \frac{\cancel{x^2}\cancel{y^3}}{\cancel{4x^2y^2}} = \boxed{\frac{y}{8x^3}}$

2 is common

(38b) $\frac{2a+6}{a^3} \div \frac{a+3}{a} = \frac{2\overset{1}{\cancel{(a+3)}}}{\cancel{a^3}a^2} \cdot \frac{\overset{1}{\cancel{a}}}{\cancel{a+3}\,1}$

$= \boxed{\frac{2}{a^2}}$

(38c) $\frac{x^2-4x+3}{x^2-9} \div \frac{6x^2-x-2}{x^2-4x-21}$

lots of factoring should help

$\frac{\cancel{(x-3)}(x-1)}{(x+3)\cancel{(x-3)}} \div \frac{(3x-2)(2x+1)}{(x-7)(x+3)}$

$\frac{(x-1)}{\cancel{x+3}} \cdot \frac{(x-7)\cancel{(x+3)}}{(3x-2)(2x+1)}$

$\boxed{\frac{(x-1)(x-7)}{(3x-2)(2x+1)}}$

$\boxed{39a}$ $\frac{3}{x} + \frac{4}{5} \Longrightarrow \frac{3(5)}{x(5)} + \frac{4(x)}{5(x)} \Longrightarrow \frac{15+4x}{5x}$

the common denominator will be $5 \cdot x$

condense to a Sigle fraction

$\boxed{\frac{4x+15}{5x}}$ answer

$\boxed{39b}$ $\frac{x-2}{x+5} - \frac{x-4}{x-3}$ $(x+5)(x-3)$ is the common denom.

$$\frac{(x-2)(x-3)}{(x+5)(x-3)} - \frac{(x-4)(x+5)}{(x-3)(x+5)}$$

$$\frac{(x-2)(x-3) - (x-4)(x+5)}{(x+5)(x-3)}$$

$$\Downarrow$$

$$\frac{x^2-3x-2x+6-(x^2+5x-4x-20)}{(x+5)(x-3)}$$

$$\frac{\cancel{x^2}-5x+6-\cancel{x^2}-x+20}{(x+5)(x-3)}$$

$$\boxed{\frac{-6x+26}{(x+5)(x-3)}}$$

$\boxed{40c}$

$$\frac{3}{x} + \frac{4}{5} + \frac{2}{x} + \frac{1}{6}$$

$30 \cdot x$ will be the common denominator

$$\frac{3(30)}{x(30)} + \frac{4(6x)}{5(6x)} + \frac{2(30)}{x(30)} + \frac{1(5x)}{6(5x)}$$

$$\frac{90+24x+60+5x}{30x}$$

$$= \boxed{\frac{29x+150}{30x}}$$

40a $\frac{4-x}{5}+2=\frac{x+1}{3}$

multiply all by 15

$$\overset{3}{\cancel{15}}\left(\frac{4-x}{\underset{1}{\cancel{5}}}\right)+15(2)=\frac{\overset{5}{\cancel{15}}(x+1)}{\underset{1}{\cancel{3}}}$$

$$3(4-x)+30=5(x+1)$$

$$\underset{+3x}{12-3x}+30=\underset{+3x}{5x+5}$$

$$42=8x+5$$

$$8x=37$$

$$\boxed{x=\frac{37}{8}}$$

40b $|2x-7|=12$

$$2x-7=12$$

$$2x=19$$

$$\boxed{x=9.5}$$

$$2x\underset{+7}{-7}=\underset{+7}{-12}$$

$$2x=-5$$

$$\boxed{x=-2.5}$$

40c $\sqrt{5-x}=2x$

square both sides

$$5-x=4x^2$$

$$0=4x^2+x-5$$

$a=4 \quad b=1 \quad c=-5$

Quadr formula

$$x=\frac{-(1)\pm\sqrt{(1)^2-4(4)(-5)}}{2(4)}$$

$$x=\frac{-1\pm\sqrt{81}}{8}=\frac{-1\pm9}{8}$$

$$x=\frac{-1+9}{8}=\boxed{1}$$

$$\frac{-1-9}{8}=\frac{-10}{8}=\boxed{-5/4}$$

40d $\underset{-12}{12}-\left[\frac{2x}{3}+x\right]=\underset{-12}{2}$

subtract 12 then multiply by -1

$$-\left[\frac{2x}{3}+x\right]=-10$$

$$\frac{2x}{3}+x=10$$

multiply by 3 to remove fractions

$$2x+3x=30$$

$$5x=30$$

$$\underline{\underline{x=6}}$$

41a $2x-4 \le 12$

find the boundary points by solving

$2x-4=12$

$2x=16$

$x=8$

TEST A point above or below

I'll test $x=0$

$2(0)-4 \le 12$

$-4 \le 12$

true

$x \le 8$

41b $|x-5| > 13$

$|x-5| = 13$

$x-5=13$

$x=18$

$x-5=-13$

+5 +5

$x=-8$

therefore boundary points are 18 and -8

I'll test a point between them, $x=0$

$|0-5| > 13$

$5 > 13$

false

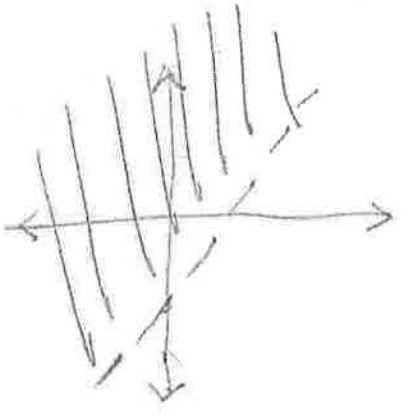
$x < -8$ or $x > 18$

42a boundary equation for $5x-2y<10$

is $5x-2y=10$

$-2y=-5x+10$

$y=\frac{5}{2}x-5$



I'll test $(0,0)$ $5(0)-2(0)<10$

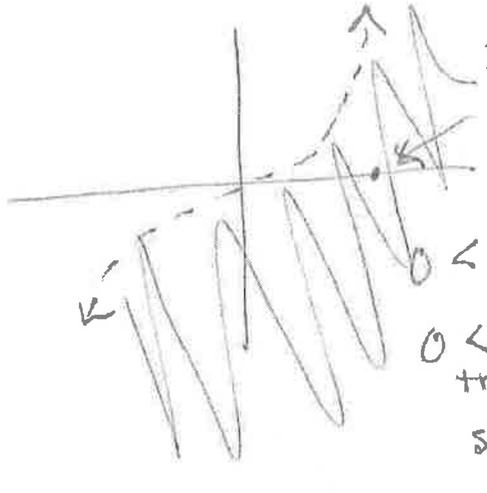
$0<10$

true

so shade above

42b $y < 0.05x^3$

boundary equation is $y=.05x^3$



I'll test $(10,0)$

$0 < .05(10)^3$

$0 < 50$

true

so shade below