

I

$$a) (16)^{-\frac{3}{4}}$$

$$= \frac{1}{16^{\frac{3}{4}}}$$

$$= \frac{1}{(4\sqrt{16})^3}$$

$$= \frac{1}{(2)^3}$$

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

$$b) 16^{\frac{1}{4}}$$

$$= 4\sqrt{16}$$

$$= 2$$

$$c) 8^{\frac{4}{3}}$$

$$= (3\sqrt{8})^4$$

$$= (2)^4$$

$$= 16$$

$$d) 36^{\frac{1}{2}}$$

$$= 2\sqrt{36}$$

$$= 6$$

$$e) 4^0 = 1$$

$$f) -4^0$$

$$= -(1)$$

$$= -1$$

$$g) -3^{-3}$$

$$= -(3^{-3})$$

$$= -\left(\frac{1}{3^3}\right)$$

$$= -\left(\frac{1}{27}\right)$$

$$= -\frac{1}{27}$$

II

$$a) 16^{\frac{1}{4}} \cdot 4^{\frac{1}{2}}$$

$$= 4\sqrt{16} \cdot 2\sqrt{4}$$

$$= 2 \cdot 2$$

$$= 4$$

$$b) 2^{\frac{1}{2}} \cdot 8^{\frac{4}{3}}$$

$$= \sqrt{2} \cdot (3\sqrt{8})^4$$

$$= \sqrt{2} \cdot 2^4$$

$$= 16\sqrt{2}$$

$$c) \sqrt{x} \cdot \sqrt[3]{x}$$

$$= x^{\frac{1}{2}} \cdot x^{\frac{1}{3}}$$

$$= x^{\frac{1}{2} + \frac{1}{3}}$$

$$= x^{\frac{5}{6}}$$

$$d) x^{\frac{1}{4}} \cdot x^{-\frac{1}{2}} \cdot x^3$$

$$= x^{\frac{1}{4} - \frac{1}{2} + 3}$$

$$= x^{\frac{11}{4}}$$

$$e) \frac{x^{\frac{1}{2}}}{x^{-\frac{2}{3}}}$$

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

$$= x^{\frac{7}{6}}$$

$$f) 6x^5z^{10} \cdot \frac{4}{10x^{17}z} \cdot 10^{-1}$$

$$= \frac{(6)(4)}{(10)(10)} \frac{x^5 z^{10}}{x^{17} z}$$

$$= \frac{6 z^9}{25 x^{12}}$$

III

$$a) \frac{x^5}{x^2} = x^3$$

$$b) \frac{x^5 y^3}{y^2} = x^5 y$$

$$c) \frac{9x^7 y^8 z^7}{z^{14}} = \frac{9x^7 y^8}{z^7}$$

$$d) \frac{x^{-2}}{x^2} = \frac{1}{x^2 x^2} = \frac{1}{x^4}$$

$$e) \frac{(x^2 y^3)^2}{y^{-3}} = \frac{x^4 y^6}{y^{-3}} = x^4 y^6 y^3$$

$$= x^4 y^9$$

$$f) \frac{x^{-1} y^{-5} z^2}{x^{-5}}$$

$$= \frac{x^5 z^2}{x^1 y^5}$$

$$= \frac{x^4 z^2}{y^5}$$

$$g) \left(\frac{z^6 x^2}{m^{24}} \right)^{\frac{5}{6}} = \frac{z^{6 \cdot \frac{5}{6}} x^{2 \cdot \frac{5}{6}}}{m^{24 \cdot \frac{5}{6}}}$$

$$= \frac{z^5 x^{\frac{5}{3}}}{m^{20}}$$

$$h) \left(\frac{3^4 x^{-2} y^{-4}}{3^5 x y^5} \right)^{-2}$$

$$= \frac{3^{-8} x^4 y^8}{3^{-10} x^{-2} y^{-10}}$$

$$= \frac{3^{10} x^4 x^2 y^8 y^{10}}{3^8}$$

$$= 3^2 x^6 y^{18}$$

$$= 9x^6 y^{18}$$

IV

$$a) 2^3 \cdot 2^2 = 2^5$$

$$b) 8 \cdot 2 = 16 = 2^4$$

$$\text{or } 8 \cdot 2 = 2^3 \cdot 2 = 2^4$$

$$c) 27 \cdot 3 = 3^3 \cdot 3 = 3^4$$

V

$$a) \frac{(2^3 \cdot 3^{-1})^2}{4}$$

$$= \frac{2^6 3^{-2}}{2^2}$$

$$= \frac{2^4}{3^2}$$

$$b) \frac{(4^{-1} \cdot 5^{-1})^{-4}}{25^{-\frac{1}{2}}}$$

$$= \frac{4^4 5^4}{25^{-\frac{1}{2}}}$$

$$= 4^4 5^4 25^{\frac{1}{2}}$$

$$= 4^4 5^4 (5^2)^{\frac{1}{2}}$$

$$= 4^4 5^4 5$$

$$= 4^4 5^5$$

$$c) \frac{(x^{-2} \cdot y^{-4} \cdot 3)^{-1}}{3x^{-5}}$$

$$= \frac{x^2 y^4 3^{-1}}{3x^{-5}}$$

$$= \frac{x^2 x^5 y^4}{3 \cdot 3}$$

$$= \frac{x^7 y^4}{3^2}$$

VI

$$a) 1. y = mx + b$$

$$-5 = 3(-4) + b$$

$$-5 = -12 + b$$

$$-5 + 12 = b$$

$$7 = b$$

slope-intercept form is

$$y = 3x + 7$$

2) standard form is

$$3x - y = -7$$

3) point-slope form is

$$(y + 5) = 3(x + 4)$$

VII

a) Parallel lines have the same slope.

$$1. y = mx + b$$

$$-6 = 5(-3) + b$$

$$-6 = -15 + b$$

$$-6 + 15 = b$$

$$9 = b$$

slope-int. form $y = 5x + 9$

standard form $5x - y = -9$

point-slope form $(y + 6) = 5(x + 3)$

$$b) 5x - 3y = 3x + 5y$$

$$5x - 3x = 5y + 3y$$

$$2x = 8y$$

$$2x - 8y = 0 \quad \text{write in slope-int. form to find slope}$$

$$8y = 2x$$

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

Use $m = -4$, since perpendicular

Solve for b , $y = mx + b$

$$-3 = -4(1) + b$$

$$1 = b$$

slope-int form $y = -4x + 1$

standard form $4x + y = 1$

point-slope form $(y + 3) = -4(x - 1)$

VIII

a) $2|x-1| = 5$

$$|x-1| = \frac{5}{2}$$



$$x-1 = \frac{5}{2} \quad \text{or} \quad x-1 = -\frac{5}{2}$$

$$x = \frac{7}{2} \quad \text{or} \quad x = -\frac{3}{2}$$

b) $2|x+7| \leq 6$

$$|x+7| \leq 3$$



$$x+7 \leq 3 \quad \text{and} \quad x+7 \geq -3$$

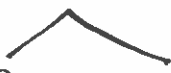
$$x+7 \leq 3 \quad \cap \quad x+7 \geq -3$$

$$x \leq -4 \quad \cap \quad x \geq -10$$

Solution: $-10 \leq x \leq -4$

c) $3|x-5| \geq 10$

$$|x-5| \geq \frac{10}{3}$$



$$x-5 \geq \frac{10}{3} \quad \text{or} \quad x-5 \leq -\frac{10}{3}$$

$$x \geq \frac{25}{3} \quad \cup \quad x \leq \frac{5}{3}$$

d) $|4x-5| = 6$

$$4x-5 = 6 \quad \text{or} \quad 4x-5 = -6$$

$$4x = 11 \quad \cup \quad 4x = -1$$

$$x = \frac{11}{4} \quad \text{or} \quad x = -\frac{1}{4}$$

e) $|2x-1| = -3$

No solution. because the absolute value of a number is the distance from 0 in the number line and distance cannot be negative.

Simplify IX

a) $11q^3 - 4q^2 + 2$

b) $14w^4 - 10w^3 - 3$

c) $4x^2 - 12x + 11$

d) $7t^4 + t$

Multiply

a) $16d^2 - 8de + e^2$

b) $16x^2 + 40xy + 25y^2$

c) $c^2 + 10cd + 25d^2$

d) $4x^2 + 20xy + 25y^2$

e) $x^2 + 3x - 10$

f) $15x^2 + 14x - 8$

g) $8x^2 + 6xy + y^2$

h) $x^2 + 6x - 7$

i) $2y^7 + 4y^6 - 12y^4 + 10y^3$

j) $-2x^4y + 6x^3y^2 - 10x^2y^4$

k) $-15x^2 + 9xy$

l) $-2x^4y^2 + 6x^7y^4 + 8x^2y^3$

m) $x^3 - 14x + 8$

n) $2x^3 + 8x^2 - 6x - 12$

o) $3x^3 - 9x^2 + 3x + 6$

p) $x^3 - 7x^2 + 10x + 6$

X

$$a) \frac{3y + yz}{2y} = \frac{\cancel{y}(3+z)}{\cancel{2y}} = \frac{3+z}{2}$$

$$b) \frac{-9x}{x(1+x)} = \frac{-9}{x+1}$$

$$c) \frac{\cancel{4}(x-4)^2(x+1)^9}{\cancel{20}(x-4)^4(x+1)^4} = \frac{(x+1)^5}{5(x-4)^2}$$

$$d) \frac{3u+uv}{4u} = \frac{\cancel{u}(3+v)}{4\cancel{u}} = \frac{3+v}{4}$$

$$e) \frac{-x^2+x+2}{2-x} = \frac{-(x^2-x-2)}{-(x-2)} = \frac{\cancel{-(x-2)}(x+1)}{\cancel{-(x-2)}} = x+1$$

$$f) \frac{x^2-6x-27}{x^2-9} \overset{\text{factor}}{=} \frac{(x-9)(x+3)}{(x-3)(x+3)} = \frac{x-9}{x-3}$$

$$g) \frac{x^2-3x-10}{5-x} = \frac{(x-5)(x+2)}{-(x-5)} = -(x+2)$$

$$h) \frac{2y^2}{5} \cdot \frac{15x}{6y} = \frac{\cancel{30}xy^2}{\cancel{30}y} = xy$$

$$\begin{aligned} i) & \frac{15r^2+22r+8}{5r^2+16r-16} \cdot \frac{5r^2-4r}{4-9r^2} \overset{\text{factor}}{=} \\ &= \frac{(5r+4)(3r+2)}{(5r-4)(r+4)} \cdot \frac{r(5r-4)}{-(3r+2)(3r-2)} \\ &= -\frac{r(5r+4)}{(r+4)(3r-2)} \end{aligned}$$

X (Continuation)

$$j) \frac{x-1}{4x-y} \cdot \frac{16x^2-y^2}{2x^2+x-3} = \frac{\cancel{(x-1)}}{\cancel{(4x-y)}} \cdot \frac{(4x+y)\cancel{(4x-y)}}{(2x+3)\cancel{(x-1)}} = \frac{4x+y}{2x+3}$$

$$k) \frac{x^2}{x+7} \cdot \frac{x^2+6x-7}{x^2+3x} = \frac{\cancel{x^2}}{\cancel{(x+7)}} \cdot \frac{\cancel{(x+7)}(x-1)}{\cancel{x}(x+3)} = \frac{x(x-1)}{(x+3)}$$

$$l) \frac{x+2}{4x^2} - \frac{-2x-1}{9x} + \frac{7x}{24} \quad \text{LCD is } 72x^2$$

$$= \frac{x+2}{4x^2} \cdot \frac{18}{18} - \frac{-2x-1}{9x} \cdot \frac{8x}{8x} + \frac{7x}{24} \cdot \frac{3x^2}{3x^2}$$

$$= \frac{18x+36}{72x^2} - \frac{-16x^2-8x}{72x^2} + \frac{21x^3}{72x^2}$$

$$= \frac{18x+36+16x^2+8x+21x^3}{72x^2}$$

$$= \frac{21x^3+16x^2+26x+36}{72x^2}$$

$$m) \frac{4}{(x+4)(x-4)} + \frac{6}{(x-6)} - \frac{2}{(x-4)} \quad \text{LCD is } (x+4)(x-4)(x-6)$$

$$= \frac{4}{(x+4)(x-4)} \cdot \frac{(x-6)}{(x-6)} + \frac{6}{(x-6)} \cdot \frac{(x-4)(x+4)}{(x-4)(x+4)} - \frac{2}{(x-4)} \cdot \frac{(x+4)(x-6)}{(x+4)(x-6)}$$

$$= \frac{4x-24}{(x+4)(x-4)(x-6)} + \frac{6x^2-96}{(x+4)(x-4)(x-6)} - \frac{2x^2-4x-48}{(x+4)(x-4)(x-6)}$$

$$= \frac{4x^2+8x-72}{(x+4)(x-4)(x-6)}$$

$$n) \frac{x+2}{4x^2} - \frac{x+2}{9x} + \frac{5x}{24} \quad \text{LCD is } 72x^2$$

$$= \frac{x+2}{4x^2} \cdot \frac{18}{18} - \frac{x+2}{9x} \cdot \frac{8x}{8x} + \frac{5x}{24} \cdot \frac{3x^2}{3x^2}$$

$$= \frac{18x+36}{72x^2} - \frac{8x^2+16x}{72x^2} + \frac{15x^3}{72x^2}$$

$$= \frac{15x^3-8x^2+2x+36}{72x^2}$$

XI

Factor

- a) $(2x+3)(x-5)$
- b) $(3x-5)(x+4)$
- c) $(3x-5)(x+1)$
- d) $(4x+3)(2x-3)$
- e) $3x(x+2)(x-3)$
- f) $6x^2y(4x+3y)(3x-y)$
- g) $4(2x+5)(5x-4)$
- h) $3x(x-3)(x+2)$
- i) $(4x-5y)(4x+5y)(16x^2+25y^2)$
- j) $(x-3y)(x+3y)(x^2+9y^2)$
- k) $(2x-1)(2x+1)(4x^2+1)$
- l) $(x+1)(x-1)(x^2+1)$
- m) $(\frac{1}{2}x+1)(\frac{1}{2}x-1)$
- n) $(\frac{1}{3}x+\frac{1}{4})(\frac{1}{3}x-\frac{1}{4})$

XII

$$\begin{aligned} \text{a) } x^2 &= 9 \\ \sqrt{x^2} &= \pm\sqrt{9} \\ x &= \pm 3 \end{aligned}$$

$$\begin{aligned} \text{b) } (x+4)^2 &= 4 \\ \sqrt{(x+4)^2} &= \pm\sqrt{4} \\ x+4 &= \pm 2 \\ x &= -4 \pm 2 \\ x &= -2 \text{ or } x = -6 \end{aligned}$$

$$\begin{aligned} \text{c) } 4(x-4)^2 - 72 &= 0 \\ \frac{4(x-4)^2}{4} &= \frac{72}{4} \\ \sqrt{(x-4)^2} &= \pm\sqrt{18} \\ x-4 &= \pm 3\sqrt{2} \\ x &= 4 \pm 3\sqrt{2} \end{aligned}$$

$$\begin{aligned} \text{d) } x^2 &= 4 \\ \sqrt{x^2} &= \pm\sqrt{4} \\ x &= \pm 2 \end{aligned}$$

$$\begin{aligned} \text{e) } 4x^2 - 5x - 9 &= 0 \\ \text{factor} \\ (4x-9)(x+1) &= 0 \\ 4x-9=0 & \quad x+1=0 \\ x=\frac{9}{4} & \quad x=-1 \end{aligned}$$

$$\begin{aligned} \text{f) } 3x^2 + 15x - 72 &= 0 \\ 3(x^2 + 5x - 24) &= 0 \\ 3(x+8)(x-3) &= 0 \\ x &= -8 \quad x = 3 \end{aligned}$$

$$\begin{aligned} \text{g) } x^4 + 10x^2 + 16 &= 0 \\ (x^2+8)(x^2+2) &= 0 \\ x^2+8=0 & \quad x^2+2=0 \\ \text{No solution} & \quad \text{No solution} \end{aligned}$$

$$\begin{aligned} \text{h) } 2x^2 + 10x - 8 &= 0 \\ 2(x^2 + 5x - 4) &= 0 \\ \text{not factorable} \\ \text{Use Quadratic Formula} \\ x &= \frac{-5 \pm \sqrt{5^2 - 4(1)(-4)}}{2(1)} \\ x &= \frac{-5 \pm \sqrt{41}}{2} \end{aligned}$$

i) $x^2 - 4x - 8 = 0$
 not factorable, use
 Quadratic Formula

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - (4)(1)(-8)}}{2(1)}$$

$$= \frac{4 \pm \sqrt{48}}{2}$$

$$= \frac{4 \pm 4\sqrt{3}}{2}$$

$$= 2 \pm 2\sqrt{3}$$

j) $x^2 - 8x + 15 = 0$
 $(x-5)(x-3) = 0$
 $x = 5$ or $x = 3$

$x |||$

By graphing

a) No solution because lines are parallel

b) $x = -5, y = 8$

c) Graphing is not a good method to use. Use substitution or elimination

$$x = -\frac{5}{6} \quad y = -\frac{1}{2}$$

d) $x = 4, y = 2$

e) $x = -5, y = 3$

By substitution or elimination

a) $\begin{cases} y = x - 4 \\ y = 2x \end{cases}$

$$2x = x - 4$$

$$x = -4$$

$$y = 2x = -8$$

b) $x = 2, y = 3$

c) $\begin{cases} x + 4y = 5 \\ x - 3y = -9 \end{cases}$

$$\begin{aligned} x + 4y &= 5 \\ -x + 3y &= 9 \end{aligned}$$

$$7y = 14$$

$$y = 2$$

$$x + 4(2) = 5$$

$$x + 8 = 5$$

$$x = -3$$

d) $x = -6, y = -18$

e) $\begin{cases} x + y = 115 \\ x - y = 45 \end{cases}$

$$x = 80 \quad y = 35$$

the numbers are 80 and 35

f) $\begin{cases} b + f = 200 \\ b = 7f \end{cases}$

$$b = 175 \quad f = 25$$

the building is 175ft high and the flagpole is 25 ft high.

LEARN XIV and XV on your own. Use books or online lessons.

XVI

y = value remaining
 x = number of visits

$$y = 223 - 5x$$

the value remaining
 after 9 visits is \$178.

$$y = 223 - 5(9)$$

$$y = 178$$

XVII

$$a) \frac{\sqrt{x}}{\sqrt{x}-\sqrt{2}} \cdot \frac{\sqrt{x}+\sqrt{2}}{\sqrt{x}+\sqrt{2}}$$

$$= \frac{x + \sqrt{2x}}{x-2}$$

$$b) \frac{1}{\sqrt{7}+\sqrt{5}} \cdot \frac{\sqrt{7}-\sqrt{5}}{\sqrt{7}-\sqrt{5}}$$

$$= \frac{\sqrt{7}-\sqrt{5}}{7-5}$$

$$= \frac{\sqrt{7}-\sqrt{5}}{2}$$

XVIII

$$\begin{aligned} a) & 4\sqrt{3} - \sqrt{64} + 6\sqrt{27} \\ &= 4\sqrt{3} - 8 + 6 \cdot 3\sqrt{3} \\ &= 4\sqrt{3} - 8 + 18\sqrt{3} \\ &= -8 + 22\sqrt{3} \end{aligned}$$

$$\begin{aligned} b) & 9\sqrt{3} - 2\sqrt{3} - 4\sqrt{3} \\ &= 3\sqrt{3} \end{aligned}$$

XIX

$$a) \text{ Domain : } \{-4, 6, 4\}$$

$$b) \text{ Domain : } x \in \mathbb{R}$$

$$\text{Range : } y < 5$$

$$c) \text{ Domain : } x \in \mathbb{R}$$

$$\text{Range : } y \geq 2$$

XX

$$a) \frac{F}{a} = \frac{ma}{a}$$

$$\frac{F}{a} = m$$

$$b) \frac{E}{c^2} = \frac{mc^2}{c^2}$$

$$\frac{E}{c^2} = m$$

$$c) B = 4c^2 + t$$

$$B - 4c^2 = t$$

$$d) A = \frac{7}{2}(-B+9)$$

$$\frac{2A}{7} = \frac{7(-B+9)}{7}$$

$$\frac{2}{7}A = -B+9$$

$$B = 9 - \frac{2}{7}A$$

XXI

- a) $f(x) = 4x^2 - 36x + 80$
Equation is quadratic
so graph is a parabola.
Find x -int. make $y=0$

$$0 = 4x^2 - 36x + 80$$

$$0 = 4(x^2 - 9x + 20)$$

$$0 = 4(x-4)(x-5)$$

$x=4, x=5$ are
the x -int.

Find y -int, make $x=0$

$$y = 4(0)^2 - 36(0) + 80$$

$$y = 80$$

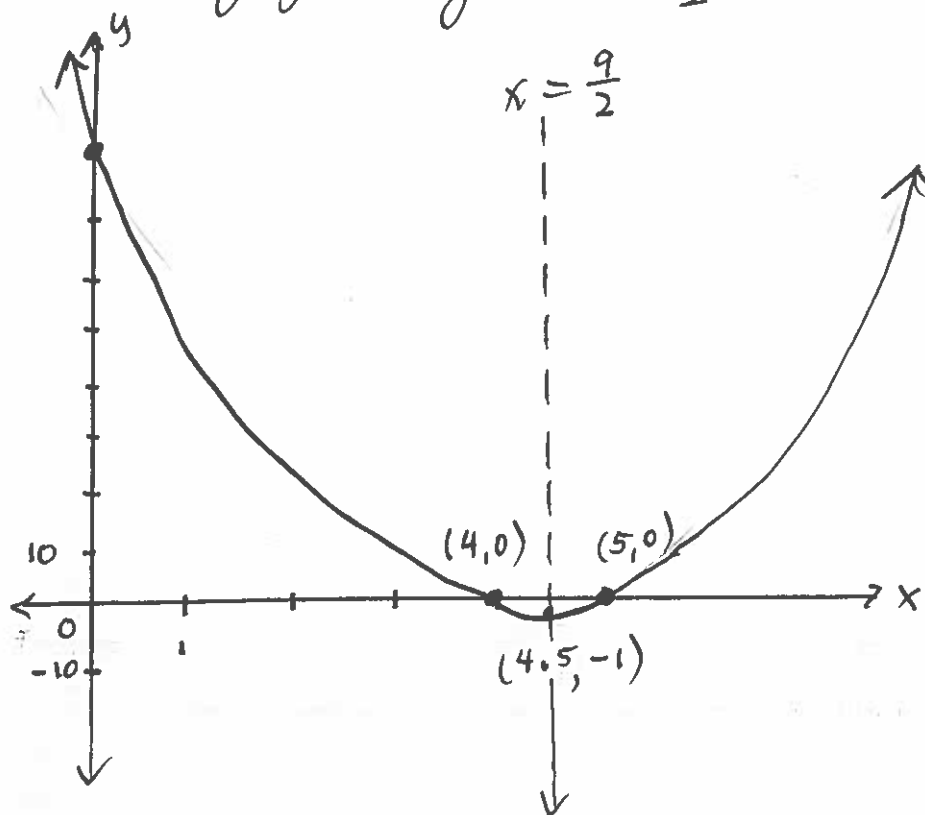
Find vertex. (h, k)

$$h = \frac{-b}{2a} = \frac{-(-36)}{2(4)} = \frac{9}{2} \text{ or } 4.5$$

$$k = 4\left(\frac{9}{2}\right)^2 - 36\left(\frac{9}{2}\right) + 80 = -1$$

Vertex is $\left(\frac{9}{2}, -1\right)$

Axis of symmetry is $x = \frac{9}{2} \text{ or } 4.5$



- b) this is an exponential growth problem.

1985 to 1994 consists
of 9 years

$$\text{Subscribers} = 280(1.7)^9$$

$$= 33204.6$$

there will be approximately

33,205 subscribers
in 1994.