CHAPTER 7
Quadratic Equations and Graphs

7.1 Solving Quadratic Equations

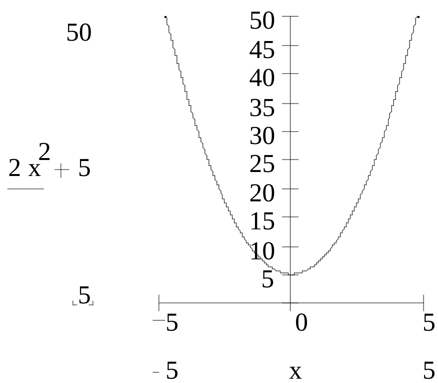
1) <u>Linear</u> | <u>Quadratic</u>

Linear	Quadratic
$2x-3=0$	$2x^2-3=0$
$2x=3$	$2x^2=3$
$x=\frac{3}{2}=1.5$	$x^2=\frac{3}{2}$
	$x=\pm\sqrt{\frac{3}{2}}$

a) All steps of solving both equations are similar except the last step of solving the quadratic.

b) With the quadratic, we must undo the square by taking the square root of both sides of the equation as the last step.

3) $y=2x^2+5$



The slope of this graph is always changing, so it could not be a linear equation, because linear equations have slopes that remain constant (they don't change). You'll learn more about quadratic equations in Section 7.2.

5) $(2x-1)^2=100$

$2x-1=\pm\sqrt{100}$

$2x-1=\pm 10$

$2x-1=10$ or $2x-1=-10$

$2x=11$ or $2x=-9$

$x=\frac{11}{2}$ or $x=-\frac{9}{2}$

7)

a) 2 ç$(x+2)^2$ is close to x^2+4x

b) 4 ç$(x+2)^2=x^2+4x+4$

c) $x^2 + 4x = 13$

$x^2 + 4x + 4 = 13 + 4$ Left side of equation is now a perfect square

$(x+2)^2 = 17$

$x + 2 = \pm\sqrt{17}$

$x + 2 = \sqrt{17}$ or $x + 2 = -\sqrt{17}$

$x = -2 + \sqrt{17}$ or $x = -2 - \sqrt{17}$

9) $V = 550 \text{ cm}^3; h = 12.5 \text{ cm}$

$550 \text{ cm}^3 = \pi r^2 (12.5 \text{ cm})$ or $550 \text{ cm}^3 = (12.5\pi \text{ cm}) r^2$

a) Graph Y_1 = 550 and Y_2 = $12.5\pi\ X^2$ and find their point of intersection:

<u>Window</u>: Xmin = 0 Xmax = 4.7 Xscl = 0.5

Ymin = 0 Ymax = 600 Yscl = 60

Hit [2nd] [CALC] [5] (intersect). Hit [ENTER] three times.

$r \approx 3.7 \text{ cm}$

<u>Note</u>: The above graphs actually intersect in two places. However, for this application, the radius of the can must be positive, not negative. (The other solution is $x \approx -3.7$). This is why we restricted our viewing window so that only Quadrant I would be seen.

b) $550 \text{ cm}^3 = \pi r^2 (12.5 \text{ cm})$

$r^2 = \dfrac{550 \text{ cm}^3}{12.5\pi \text{ cm}}$

$r = \pm\sqrt{\dfrac{44}{\pi} \text{cm}^2}$

$r = \sqrt{\dfrac{44}{\pi}} \text{ cm}$ çNote we ignore the negative root (Why?)

11) $C = \frac{2\pi}{5} d^2$, (C is in grams, d in inches).

a) $C = \frac{2\pi}{5}(10)^2 = \frac{2\pi}{5}(100) \approx 126 \text{ g}$ of cheese.

b) $400 = \frac{2\pi}{5} d^2$

$d^2 = \frac{5}{2\pi}(400)$

$d = \pm\sqrt{\dfrac{2000}{2\pi}}$

$d = \sqrt{\dfrac{1000}{\pi}} \approx \sqrt{318} \approx 17.84 \text{ in}$ çWe ignore the negative diameter.

13)

a) $y = (x-8)(x+6)$

b) The value for *y* is 0 at the *x*-intercepts:
$0 = (x-8)(x+6)$
$x-8=0$ or $x+6=0$ çZero product property
$x=8$ or $x=-6$
The *x*-intercepts are (8,0) and ($^{-}$6,0).

c) The value for *x* is zero at the *y*-intercept:
$y = (0-8)(0+6) = (-8)(6) = -48$
The *y*-intercept is (0,$^{-}$48)

15) Let *x* = the person's age
Let *y* = the other age

$x + y = 52$
$x + y^2 = 142$

From the first equation, we have $x = 52 - y$. Substituting this expression for *x* in the second equation gives
$(52-y) + y^2 = 142$
$52 - y + y^2 = 142$
$y^2 - y - 90 = 0$ çObtain a quadratic equation set equal to zero
$y^2 + 9y - 10y - 90 = 0$ çSplit the middle term to factor (Section 6.4)
$(y^2 + 9y) + (-10y - 90) = 0$ çGroup the terms
$y(y+9) + (-10)(y+9) = 0$ çFactor out the GCF of both groups
$(y-10)(y+9) = 0$ çFactor out the binomial (*y* + 9)
$(y-10) = 0$ or $(y+9) = 0$ çZero product property
$y = 10$ or $y = -9$
y = other age = 10 (We ignore *y* = $^{-}$9 because an age cannot be negative).

Thus *x* + 10 = 52
è*x* = person's age = 42 yrs

Skill and Review

17) $\dfrac{-(-7)}{2(1)} + \dfrac{\sqrt{(-7)^2 - 4(1)(12)}}{2(1)}$
$= \dfrac{7}{2} + \dfrac{\sqrt{49-48}}{2}$

$$= \frac{7}{2} + \frac{1}{2}$$
$$= \frac{8}{2}$$
$$= 4$$

19) $z - \frac{3}{4} = \frac{1}{3}z + \frac{1}{2}$

$12\left(z - \frac{3}{4}\right) = 12\left(\frac{1}{3}z + \frac{1}{2}\right)$ ← Multiply both sides of equation by LCD

$12z - 9 = 4z + 6$

$8z = 15$

$z = \frac{15}{8} = 1.875$

Check:

$\left(\frac{15}{8}\right) - \frac{3}{4} = \frac{1}{3}\left(\frac{15}{8}\right) + \frac{1}{2}$

$\frac{15}{8} - \frac{6}{8} = \frac{5}{8} + \frac{4}{8}$ ← Write each fraction with the same denominator (LCD)

$\frac{9}{8} = \frac{9}{8}$