UNIT 5: SOLVING QUADRATIC EQUATIONS

Note-Taking Supplement

Student Package

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Lesson 1
Solving Quadratics by Factoring

1.1 Factoring

Factor $x^2 + 5x + 6$

$2x^2 + 10x + 12$

1.2 Factoring

$6x^2 - 13x - 5$

Factoring a binomial in the form $ax^2 + bx$

1.3 Zero Product Property

$(x - 3)(x + 5)$ What value of x will make this expression equal 0?

$(2x - 7)(3x + 5)$ What value of x will make this expression equal 0?

1.4 Solve by Factoring

Solve $x^2 - 7x + 10 = 0$ by factoring.

1.5 Solve by Factoring

Solve $3x^2 + 11x - 4 = 0$ by factoring.

Example 1 Solve the following by factoring.

a) $3x^2 - 15x - 18 = 0$

b) $10x^2 + 7x - 12 = 0$

1.6 Solve by Factoring

Before factoring write the quadratic in the form

a) $x^2 + 8x = 3x + 24$

b) $3x(x+1) = 5(x+2) - 5$

c) $x + \dfrac{6}{x+4} = 3$

1.7 Roots of Quadratic Equations

Solve: $x^2 + x - 12 = 0$

Write the quadratic equation whose roots are 3 and -4.

Example 2

Write the quadratic equation whose roots are $-\frac{1}{3}$ and $\frac{5}{9}$.

1.8 Solve by Factoring

$$(x-4)^2 + 5(x-4) - 6 = 0$$

Example 3

Solve by factoring: $2(x+1)^2 + 7(x+1) - 15 = 0$

1.9 Solving Combinations of Equations

Example 4 Solving the following equation algebraically.

$$\sqrt{x-5}+7=x$$

Example 5 Solving the following equation algebraically.

$$x=\sqrt{x-4}+6$$

1.10 Solving Combinations of Equations

Example 6 Solving the following equation algebraically.

$$\sqrt{2x+3} - \sqrt{x+2} + 7 = 2$$

1.11 Solving Combinations of Equations

Example 7 Solving the following equation algebraically.

a) $\sqrt{x-5} + \sqrt{x+4} = 9$

b) $\sqrt{x-5} + \sqrt{2x+7} = -3$

Lesson 2
Solving Quadratics by The Square Root Principle

2.1 Square Root Principle

Difference of squares

$a^2 - 9$

Solve: $a^2 - 9 = 0$

Solve: $a^2 = 9$

When do you use the square root principle?

$ax^2 + bx + c = 0$

2.2 Square Root Principle

Solve using the square root principle.

a) $2x^2 - 32 = 0$

Solve by factoring

b) $2x^2 - 32 = 0$

2.3 Square Root Principle

Solve by factoring.

$2x^2 - 14 = 0$

Solve using the square root principle.

$2x^2 - 14 = 0$

Example 1 Solve the following quadratics, answer in exact form.

a) $4x^2 - 12 = 0$

b) $25x^2 - 15 = 0$

2.4 Square Root Principle

Solve by factoring.

$(x-4)^2 = 9$

2.5 Square Root Principle

Example 2 Solve each of the quadratic equations for their exact values by using the square root principle.

a) $(3x-2)^2 + 8 = 32$

b) $-3(3x+6)^2 + 20 = -34$

2.6 Applications

Example 3 Eight less than twice the square of an integer is 90. Find the integer.

Example 4 Squaring five less than an integer gives 324. What is the integer?

Lesson 3
Solving Quadratics Using the Quadratic Formula

3.1 Quadratic Formula

$x^2 - 2x - 1 = 0$ Is this quadratic equation a good candidate to solve using the square root principle? Why or why not?

Can solve a quadratic equation using the quadratic formula.

3.2 Quadratic Formula

Example 1

Solve each of the quadratic equations for their exact values by using the Quadratic Formula.

Note: Equation must be in the form: $ax^2 + bx + c = 0$

a) $x^2 + (x+6)(x-1) = 10x + 9$

b) $\frac{4}{x+5} + 3 = \frac{1}{x}$

3.3 Quadratic Formula

Example 2

A swimming pool has a length of 8 metres and a width of 6 metres. A uniform deck is to be built around the pool. The area of the swimming pool is twice as a large as the area of the deck, how wide is the deck? Round answer to the nearest hundredth.

3.4 Quadratic Formula

Example 3

The length and width of a rectangular garden is 13m by 9m. A Gardner wishes to double the area. How much must be added equally to the length and width of the garden to double the area? Round answer to the nearest hundredth.

3.5 Quadratic Formula

Example 4

A helicopter flies from Vancouver to Calgary a distance of 677km with a tailwind. On the return trip the helicopter was 40 km/h slower. The total flying time for both flights was 6.5 hours. How fast was the helicopter flying to Calgary? Round answer to nearest hundredth.

3.6 Quadratic Formula

Example 5

A train and a car both travel 200 km. The average speed of the car is 24 km/h faster than that of the train. If the car covers the distance in 45 minutes less time then the train, then find the speed of the Car. Round answer to the nearest hundredth.

3.7 Quadratic Formula

Example 6

Two hoses turned on together can fill an Aquarium at the Vancouver Zoo in 5 hours. By themselves, one hose takes 2 hours longer than the other hose. Determine the time taken to fill the Aquarium by each hose on its own. Round answer to the nearest hundredth.

3.8 Quadratic Formula

Example 7

When the hot water and cold water taps are turned on full they can fill a sink in 2 minutes. If the cold water tap can fill the sink 30 seconds faster than the hot water tap on its own then how long does it take each tap to fill the sink on its own? Round answer to the nearest hundredth.

Lesson 4
The Discriminant

4.1 Nature of the Roots

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ to find the roots of the general quadratic equation $axh2 + bx + c = 0$.

Determine the roots of:

$x^2 - 7x + 10 = 0$

4.2 Nature of the Roots

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ to find the roots of the general quadratic equation $axh2 + bx + c = 0$.

Determine the roots of:

$x^2 - 10x + 25 = 0$

4.3 Nature of the Roots

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ to find the roots of the general quadratic equation $axh2 + bx + c = 0$.

Determine the roots of:

$x^2 - 4x + 13 = 0$

The expression under the radical sign plays an important role in the calculation of the roots.

4.4 Nature of the Roots

Without solving a quadratic equation you can determine the nature of the roots.

$2x^2 + 5x - 1 = 0$

Example 1

Determine the value of the discriminant and then state the nature of the roots for each of the following.

a) $9x^2 - 6x + 1 = 0$

b) $6x^2 - 4x + 3 = 0$

c) $3x^2 - \sqrt{11}x - 1 = 0$

4.5 Nature of the Roots

Working backwards.

Determine all values of k for which the equation $2x^2 - 3x + k = 0$ has two different roots.

Example 2

Find the value of k so that the quadratic:

a) $3x^2 - kx + 4 = 0$ has one root (two roots the same)

b) $kx^2 - x + 5 = 0$ has no roots.