Step by step guide: Application Of Quadratic Equations To Real Life Situations

Grade 10 Mathematics | 40-Minute Lesson

Before Class Begins

Preparation Checklist:

- Write the problem-solving steps on the board
- Prepare scenario cards for each group
- Prepare exit tickets for distribution
- Set timer for phase transitions

[WRITE on board before class]:

"SOLVING REAL-LIFE QUADRATICS:
1. Read and identify what's asked
2. Define variables
3. Set up the equation
4. Solve (factor, formula, or complete square)
5. Interpret answer in context"

PHASE 1: Problem-Solving and Discovery (15 Minutes)

Opening (2 minutes)

[SAY]:

"Good morning/afternoon, class! Have you ever wondered how mathematics applies to the real world? Today we're going to see how quadratic equations help us solve everyday problems - from throwing a ball to maximizing profits!"

[SAY]:

"Our key question today is: How do we apply the concept of Quadratic equations to real life?"

Anchor Activity Introduction (3 minutes)

[SAY]:

"Each group will receive a different real-life scenario. Your task is to:

1. Identify the quadratic equation
2. Figure out what each variable represents
3. Try to solve the problem
4. Explain what your answer means in real life"

[DISTRIBUTE scenario cards to groups]

Group Work (7 minutes)

[SAY]:

"You have 6 minutes to work on your scenario. Think about: What makes this a quadratic problem? Begin!"

[DO]: Walk around the room, observing group discussions.

[ASK probing questions as you circulate]:

- "What is the equation in your problem?"
- "What does x (or t) represent in your scenario?"
- "What value are you trying to find?"
- "Does your answer make sense in real life?"

[TIME CHECK]: At 5 minutes, announce: "One more minute!"

Class Discussion (3 minutes)

[SAY]:

"Let's share discoveries. Group 1, what was your scenario about?"

[Expected answer]: "Projectile motion - a ball thrown upward"

[ASK]:

"What makes these problems quadratic?"

[Expected answer]: "They involve squared terms - like t^2 for time or x^2 for dimensions!"

[ASK]:

"Why did some groups reject certain answers?"

[Expected answer]: "Negative time or negative length doesn't make sense in real life!"

[TRANSITION]:

"Excellent observations! Let me formalize these ideas."

PHASE 2: Structured Instruction (10 Minutes)

Real-Life Applications (4 minutes)

[SAY]:

"Quadratic equations appear everywhere in real life:

• PROJECTILE MOTION: When you throw a ball, its height follows a quadratic path
• AREA PROBLEMS: When maximizing garden area with limited fencing
• BUSINESS: When calculating profit or finding break-even points
• PHYSICS: When objects fall under gravity"

The Standard Form (3 minutes)

[WRITE on board]:

"QUADRATIC EQUATION: $ax^2 + bx + c = 0$

where:
• a, b, c are constants (numbers)
• x is the unknown variable
• $a \neq 0$ (otherwise it's not quadratic)"

Problem-Solving Steps (2 minutes)

[SAY]:

"Follow these FIVE STEPS for any real-life quadratic problem:

1. READ the problem - what are you finding?
2. DEFINE variables - what does x represent?
3. SET UP the equation
4. SOLVE using factorisation, formula, or completing the square
5. INTERPRET - does your answer make sense?"

Misconception Alert (1 minute)

[SAY - IMPORTANT]:

"CAUTION! Always check if your answer makes sense!

- *Time cannot be negative*
- *Length cannot be negative*
- *Number of items must be a whole number (usually)*

Reject answers that don't fit the real-world context!"

[TRANSITION]:

"Now let's work through a complete example together!"

PHASE 3: Practice and Application (15 Minutes)

Worked Example (6 minutes)

[SAY]:

"Let's solve this problem together:

A rock is dropped from a height of 50 meters. Its height above the ground at time t is:
$h(t) = -5t^2 + 50$

How long does it take to reach the ground?"

[WRITE step by step]:

"Step 1: Understand the problem
- *The rock reaches the ground when $h(t) = 0$*
- *We need to find t*

Step 2: Set up the equation
$-5t^2 + 50 = 0$

Step 3: Solve
$-5t^2 + 50 = 0$
$-5t^2 = -50$
$t^2 = 10$
$t = \pm\sqrt{10}$

Step 4: Interpret
Time cannot be negative!
$t = \sqrt{10} \approx 3.16$ seconds"

[SAY]:

"The rock takes approximately 3.16 seconds to reach the ground.

Notice: We rejected $t = -\sqrt{10}$ because negative time doesn't exist!"

Guided Practice (7 minutes)

[SAY]:

"Try this with your partner:

A stone is thrown upward from 4 meters with initial velocity 8 m/s.
$h(t) = -5t^2 + 8t + 4$

When does it hit the ground?"

[GIVE 5 minutes, then review]:

"Solution:
$-5t^2 + 8t + 4 = 0$
Multiply by -1: $5t^2 - 8t - 4 = 0$

Using quadratic formula:
$t = (8 \pm \sqrt{(64 + 80)})/10$
$t = (8 \pm \sqrt{144})/10$
$t = (8 \pm 12)/10$

$t = 2$ or $t = -0.4$

Since time cannot be negative, $t = 2$ seconds"

[TRANSITION]:

"Now I want to see what each of you has learned."

PHASE 4: Assessment / Checkpoint (8 Minutes)

Checkpoint exploration (5 minutes)

[DO] Project the digital textbook on the screen. Navigate to the "Checkpoint" section.

[SAY] "This is our digital mathematics textbook. It has something special called checkpoints. Watch what happens when I click this button..."

[DO] Click "Show new example question" on Checkpoint

[SAY] "See? A new number appeared! And if I click again..."

[DO] Click the button again to show randomization

[SAY] "A different number! This means you can practice with hundreds of different examples. The computer never runs out of problems to give you."

[SAY] "Now it's your turn. With your partner, open the digital textbook and find the checkpoint.

[SAY] Click “Show new example question” to load the problem

[SAY] Solve the displayed question

[SAY] Click “submit” to check your answer

[SAY] If incorrect, carefully read the feedback and analyse the error before trying a new question. The immediate feedback from checkpoint submissions allows students to identify and correct errors in real-time.

[SAY] Complete at least 5 questions

[DO] Circulate among pairs. Ask probing questions, for example, what patterns do you notice?

Independent Work (5 minutes)

[DISPLAY question]:

"A school's profit function is $P(x) = -x^2 + 30x - 100$.
Find the number of units to achieve zero profit (break-even)."

[SAY]:

"You have 5 minutes. Show your working. Begin."

Collection and Closure (2 minutes)

[SAY]:

"Time's up. Please pass your exit tickets forward."

[COLLECT all tickets]

[SAY]:

"Today you learned how to APPLY quadratic equations to real life:

• Projectile motion (throwing balls, dropping objects)
• Area optimization (fencing problems)
• Business applications (profit, break-even)

Remember the 5 steps: Read, Define, Set up, Solve, Interpret!

And always check: Does your answer make sense in real life?

Great work today!"

Differentiation Notes

For Struggling Learners:

- Provide problem-solving templates
- Use simpler numbers
- Allow calculator use
- Draw diagrams for area problems

For Advanced Learners:

[GIVE these extensions]:

- Ball passing 50m mark (two times) → t = 1s and t = 4s
- Maximum area rectangle with perimeter 100m → 25m × 25m
- Maximum revenue problem → 50 units

Answer Key

Exit Ticket Answers:

1. Stone reaching ground:

$h(t) = -5t^2 + 8t + 4 = 0$

t = 2 seconds

2. Fencing problem:

Width = 25m, Length = 75m

Area = 1875 m^2

3. Profit break-even:

$P(x) = -x^2 + 30x - 100 = 0$

$x \approx 4$ units or $x \approx 26$ units

Post-Lesson Reflection Prompts

1. What went well? Did students connect equations to real contexts?

2. What would I change? Were the scenarios engaging?

3. Student Understanding: Could students interpret answers correctly?

4. Next Steps: Which students need more practice?