

# Quadratic Functions: Marking Guide (Mathematics 20-1, Grade 11)

## Task

Students present a labelled model or report on quadratic functions. The work demonstrates analysis of quadratic function characteristics, accurate graphing, and clear communication of mathematical reasoning.

## Curriculum alignment

Students are assessed on their ability to analyze quadratic functions of the form  $y = a(x - p)^2 + q$  and  $y = ax^2 + bx + c$  to identify vertex, domain and range, direction of opening, axis of symmetry, and x- and y-intercepts ([Outcome](#), [Outcome](#)). Students apply these skills to solve problems involving quadratic functions ([Outcome](#)).

## Rubric

| Criterion                                  | Beginning                                                                                                                         | Developing                                                                                         | Proficient                                                                                             | Exemplary                                                                                                                                           |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Identification of function characteristics | Identifies fewer than three characteristics (vertex, domain/range, direction of opening, axis of symmetry, intercepts) correctly. | Identifies three to four characteristics correctly; minor errors in calculation or interpretation. | Identifies all five characteristics correctly with accurate calculations and clear reasoning.          | Identifies all characteristics correctly and explains how parameter changes (a, p, q or a, b, c) affect each feature.                               |
| Graphing and labelling                     | Graph is incomplete or missing key labels; points or features are inaccurate or unlabelled.                                       | Graph shows most features; labels present but some are unclear or slightly misplaced.              | Graph is accurate with all key features clearly labelled (vertex, intercepts, axis of symmetry).       | Graph is precise and well-formatted; labels are positioned clearly; scale is appropriate and consistent.                                            |
| Mathematical communication                 | Explanations are unclear or missing; notation is inconsistent or incorrect.                                                       | Explanations present but lack detail; notation is mostly correct with minor inconsistencies.       | Explanations are clear and logical; mathematical notation is correct and used consistently throughout. | Explanations are thorough and precise; notation is correct; reasoning connects forms and features coherently.                                       |
| Problem solving and application            | Does not attempt to apply quadratic functions to a problem or application is incorrect.                                           | Attempts application with partial understanding; some steps are missing or contain errors.         | Applies quadratic functions to solve a problem; work is organized and mostly correct.                  | Applies quadratic functions to solve a problem efficiently; explains the relevance of findings and considers constraints or alternative approaches. |

## Scoring

Assign each criterion a level: Beginning = 1, Developing = 2, Proficient = 3, Exemplary = 4.

Sum the four criterion scores. Students are expected to analyze quadratic functions and determine their key characteristics. A score of 13 to 14 indicates strong proficiency; 15 to 16 indicates exemplary work. Use the overall score to assign a letter grade or percentage according to your school's grading scale.

## Notes for the teacher

- **Consistent interpretation of "correct":** Verify calculations independently. Minor rounding differences or equivalent forms (e.g.,  $y = 2(x - 3)^2 + 5$  and  $y = 2x^2 - 12x + 23$ ) both count as correct.
- **Labelling standards:** Require axes labels, scale marks, and feature labels (vertex as an ordered pair, intercepts as points, axis of symmetry as a vertical line with its equation). Accept either form notation  $y = a(x - p)^2 + q$  or standard form  $y = ax^2 + bx + c$ ; do not penalize the choice.
- **Problem-solving context:** If the task includes a real-world scenario (trajectory, profit, area), ensure the student's answer addresses the question asked and includes units or constraints where relevant.
- **Differentiation:** For support, provide a template with blanks for characteristics and a partially labelled graph. For extension, ask students to convert between forms, explain why a particular form is most useful for their problem, or compare two quadratic functions.