

Performance Task #1 — Studying Functions

Specific Expectations

The following expectations are common to the Functions and Relations course and the Functions course.

- OC2.03 determine, through investigation, the properties of the functions defined by $f(x) = \sqrt{x}$ [e.g., domain, range, relationship to $f(x) = x^2$] and $f(x) = \frac{1}{x}$ [e.g., domain, range, relationship to $f(x) = x$.];
- OC2.04 explain the relationship between a function and its inverse (i.e., symmetry of their graphs in the line $y = x$; the interchange of x and y in the equation of the function; the interchanges of the domain and range), using examples drawn from linear and quadratic functions, and from the functions $f(x) = \sqrt{x}$ and $f(x) = \frac{1}{x}$
- OC2.05 represent inverse functions, using function notation, where appropriate
- OC2.06 represent transformations (e.g., translations, reflections, stretches) of the functions defined by $f(x) = x$, $f(x) = x^2$, $f(x) = \sqrt{x}$, $f(x) = \sin x$, and $f(x) = \cos x$, using function notation
- OC2.07 describe, by interpreting function notation, the relationship between the graph of a function and its image under one or more transformations
- OC2.08 state the domain and range of transformations of the functions defined by $f(x) = x$, $f(x) = x^2$, $f(x) = \sqrt{x}$, $f(x) = \sin x$, and $f(x) = \cos x$
- OC3.04 demonstrate the correct use of mathematical language, symbols, visuals (e.g., diagrams, graphs), and conventions

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Time Required Functions and Relations or Functions: 60 min

Materials and Equipment

- graphing calculator

Overview

This *Performance Task* allows students to demonstrate that they can

- describe the properties of functions under transformations
- describe the relationship between the graph of a function and its image under transformations
- investigate and explain the relationship between a function and its inverse
- solve problems involving functions
- use appropriate mathematical forms to report the solution to a problem clearly

Description of Task

Students must choose two of three functions to analyze. Analysis should include graphs, diagrams, and algebraic responses.

Management Suggestions

Students could work individually on this *Performance Task*. If students work in pairs, each pair should explore all three functions.

Assessment Suggestions

Assess Achievement using the rubric for this *Performance Task*.

Assess Learning Skills as students work on this *Performance Task*, using the related generic rubrics. Assess the ability of students to work independently and to organize their work. You might distribute the Learning Skills Self-Assessment Checklists and ask students to fill out the Working Independently and Organization sections. (See Assessment and Evaluation in this *Teacher Resource*.)

Guidelines for Solution

Solutions should include all of the stated components in the problem and clearly describe the applied transformation(s). Diagrams and graphs should be well labelled.

Performance Task #2 — The Cost of Money

Specific Expectations

The following expectations are common to the Functions and Relations course and the Functions course.

- OC2.04 explain the relationship between a function and its inverse (i.e., symmetry of their graphs in the line $y = x$; the interchange of x and y in the equation of the function; the interchanges of the domain and range), using examples drawn from linear and quadratic functions, and from the functions $f(x) = \sqrt{x}$ and $f(x) = \frac{1}{x}$
- OC2.05 represent inverse functions, using function notation, where appropriate
- OC3.01 explain mathematical processes, methods of solution, and concepts clearly to others
- OC3.04 demonstrate the correct use of mathematical language, symbols, visuals (e.g., diagrams, graphs), and conventions

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Time Required Functions and Relations or Functions: 45–60 min

Materials and Equipment

- graphing calculator

Overview

This *Performance Task* allows students to demonstrate that they can

- investigate and explain the relationship between a function and its inverse
- solve problems involving functions
- use technology as an aid in problem solving
- solve multi-step problems
- report the solution to a problem clearly and concisely, using appropriate mathematical forms

Description of Task

This *Performance Task* requires students to create and apply equations for the inverse relation between the U.S. dollar and the Canadian dollar.

Management Suggestions

Students could work individually on this *Performance Task*.

Assessment Suggestions

Assess Achievement using the rubric for this *Performance Task*.

Assess Learning Skills as students work on this *Performance Task* using the related generic rubrics. (See Assessment and Evaluation in the *Teacher Resource*.) Also assess the ability of students to work independently.

EXTENSION

Students could research the current values of the U.S. and Canadian dollars to analyze this problem. Further, students could also research the value of several other countries' currencies, creating a spreadsheet to show the equivalent values in Canadian dollars.

Guidelines for Solution

Part (a)

One U.S. dollar is worth \$1.48 Canadian. Then the equation is

$y = 1.48x$, where y is the amount in U.S. dollars and x is the amount in Canadian dollars.

Part (b)

Both graphs will be straight lines that pass through the origin.

Part (c)

The inverse relationship represents the value of a U.S. dollar in one Canadian dollar.

The equation for the inverse is $y = \frac{1}{1.48}x$ or $y = \overline{0.675}x$, where y is the amount in U.S. dollars and x is the amount in Canadian dollars.

Part (d)

To discount Canadian dollars by 40% means that each Canadian dollar will be worth \$0.60 U.S. This is not a good deal for the person who wants to pay with U.S. dollars, since the formula in (c) means that one Canadian dollar is worth at least \$0.675 U.S.

Performance Task #3 — Exponential Equations

Specific Expectations

Unless stated otherwise, the following expectations are common to the Functions and Relations course and the Functions course.

- OC1.08(U)/OC1.07(U/C) simplify and evaluate expressions containing integer and rational exponents, using the laws of exponents
- OC1.09(U) /OC 1.08 (U/C) solve exponential equations (e.g., $4^x = 8^{x+3}$, $2^{2x} - 2^x = 12$)
- OC3.03 communicate solutions to problems and to findings of investigations clearly and concisely, orally and in writing, using an effective integration of essay and mathematical forms
- OC3.04 demonstrate the correct use of mathematical language, symbols, visuals (e.g., diagrams, graphs), and conventions
- OC3.05 use graphing technology effectively (e.g., use appropriate menus and algorithms; set the graph window to display the appropriate section of a curve)

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Time Required Functions and Relations or Functions: 45–60 min

Materials and Equipment

- graphing calculator or graphing software

Overview

This *Performance Task* allows students to demonstrate that they can

- demonstrate facility in manipulating polynomials, rational expressions, and exponential expressions
- solve problems involving functions
- solve multi-step problems
- use technology as an aid in problem solving
- report the solution to a problem clearly and concisely, using appropriate mathematical forms

Description of Task

This *Performance Task* requires students to solve exponential equations graphically and algebraically. To solve algebraically, students should express the powers with the same base.

Management Suggestions

Students could work in pairs to brainstorm what needs to be done and then work on their solutions individually. Students should create graphs using graphing calculators or graphing software.

Assessment Suggestions

Assess Achievement using the rubric for this *Performance Task*.

Guidelines for Solution

Solutions should show both the algebra and a graph for each equation and a discussion of the different methods.

Express both sides of the equation using the same base and then solve for x . For (b),

$$2^{4x-2} = 8^x \quad \text{Express 8 as } 2^3.$$

$$2^{4x-2} = 2^{3x} \quad \text{Set exponents equal.}$$

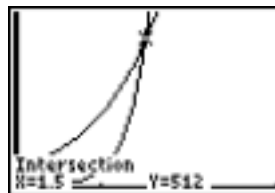
$$4x - 2 = 3x \quad \text{Solve.}$$

$$x = 2$$

For (a), $x = -1$, and for (c), $x = 1.5$.

To graph, think of each side of the equation as a separate relation and graph each relation.

For (c), $y = 4^{x+3}$ and $y = 8^{2x}$. Using graphing technology, adjust the window settings to see the intersection of the two relations. Or use the intersect command of the CALCULATE menu.



Performance Task #4 — Graphing Complex Numbers

Specific Expectations

Unless stated otherwise, the following expectations are common to the Functions and Relations course and the Functions course.

- OC1.04 identify the structure of the complex number system and express complex numbers in the form $a + bi$, where $i^2 = -1$ (e.g., $4i$, $3 - 2i$)
- OC1.06(U) add, subtract, multiply, and divide complex numbers in rectangular form
- OC3.04 demonstrate the correct use of mathematical language, symbols, visuals (e.g., diagrams, graphs), and conventions

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Time Required Functions and Relations or Functions: 45–60 min

Materials and Equipment

- graph paper or *The Geometer's Sketchpad*®

Overview

This *Performance Task* allows students to demonstrate that they can

- examine complex numbers
- solve multi-step problems
- justify their reasoning
- use technology as an aid in problem solving
- solve multi-step problems
- report the solution to a problem clearly and concisely, using appropriate mathematical forms

Description of Task

This *Performance Task* requires students to interpret complex numbers geometrically, which will be new to students, but it will allow them to connect a new concept with analytic geometry, with which they are familiar.

Management Suggestions

Using *The Geometer's Sketchpad* with this *Performance Task* would be extremely helpful, because students could test conjectures. Students should submit a full report of their work, including their conjectures and supporting cases.

Assessment Suggestions

Assess Achievement using the rubric for this *Performance Task*.

Assess the Learning Skills Independence and Initiative using the related generic rubrics. (See Assessment and Evaluation in the *Teacher Resource*.)

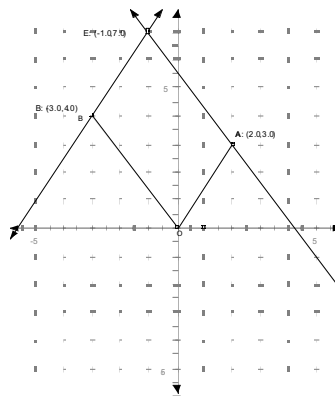
EXTENSION

Ask students to suggest why the relationship they discover holds true. Perhaps they can use their analytic geometry skills learned in grade 10 to “prove” why the relationship holds true.

Guidelines for Solution

In working with *The Geometer's Sketchpad*, students may notice that each coordinate of the point of intersection of the two parallel lines is the sum of the corresponding coordinates of points A and B.

Students should then try other complex numbers to see if this relation holds true. Solutions should show several examples of testing conjectures. Students in the Functions and Relations course may be able to connect this relationship to adding complex numbers.



Performance Task #5 — Graphing Equations

Specific Expectations

The following expectations are common to the Functions and Relations course and the Functions course.

- OC2.03 determine, through investigation, the properties of the functions defined by $f(x) = \sqrt{x}$ [e.g., domain, range, relationship to $f(x) = x^2$] and $f(x) = \frac{1}{x}$ [e.g., domain, range, relationship to $f(x) = x$];
- OC2.06 represent transformations (e.g., translations, reflections, stretches) of the functions defined by $f(x) = x$, $f(x) = x^2$, $f(x) = \sqrt{x}$, $f(x) = \sin x$, and $f(x) = \cos x$, using function notation
- OC2.07 describe, by interpreting function notation, the relationship between the graph of a function and its image under one or more transformations
- OC3.01 explain mathematical processes, methods of solution, and concepts clearly to others
- OC3.04 demonstrate the correct use of mathematical language, symbols, visuals (e.g., diagrams, graphs), and conventions

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Time Required Functions and Relations or Functions: 45–60 min

Overview

This *Performance Task* allows students to demonstrate that they can

- describe the properties of functions under transformations
- describe the relationship between the graph of a function and its image under transformations
- read and interpret the results produced by graphing technology
- communicate and justify their reasoning

Description of Task

This *Performance Task* requires students to analyze graphs shown on graphing calculator screens and to match each graph with the corresponding equation. Students must apply their knowledge of the base graphs, as well as the effects of transformations on those graphs. Students should also justify their choices. In the second part, students are expected to create an equation for a given graph.

Management Suggestions

Students could work individually on this *Performance Task*. Students should not have access to graphing technology while working on the *Performance Task*. However, once they have completed the *Performance Task*, they may check their solutions using graphing technology.

Assessment Suggestions

Assess Achievement using the rubric for this *Performance Task*.

Assess the Learning Skill Independence using the Generic Rubric for Independence. (See Assessment and Evaluation in the *Teacher Resource*.) Also assess by observing students as they work.

Guidelines for Solution

Part I

The solutions should accurately match the equations to the graphs. Students should justify each choice.

For example, both graphs D and F share the same base function, $y = \sqrt{x}$, but since the equation in vi, $y = 2\sqrt{x+1}$, is positive, then graph D is the better match. Transforming $y = \sqrt{x}$ by translating it 1 unit left and vertically stretching it by 2 produces $y = 2\sqrt{x+1}$.

Graph A matches the equation in v, graph B matches the equation in i, graph C matches the equation in ii, graph E matches the equation in iii, and graph F matches the equation in iv.

Part II

For this part, students should analyze the key components of the graph. Solutions may vary, but accept reasonable variations.

The base graph is $y = \sqrt{x}$. It appears from the screen that the base graph has been translated 1 unit right and shifted vertically up 2 units. The base graph also appears to have been stretched vertically by a factor of about 3. The graph opens down, so 3 must be negative. Therefore, the graph's equation is $y = -3\sqrt{x-1} + 2$.

Performance Task #6 — Chartering a Flight

Specific Expectations

The following expectations are common to the Functions and Relations course and the Functions course.

- OC2.06 represent transformations (e.g., translations, reflections, stretches) of the functions defined by $f(x) = x$, $f(x) = x^2$, $f(x) = \sqrt{x}$, $f(x) = \sin x$, and $f(x) = \cos x$, using function notation
- OC2.07 describe, by interpreting function notation, the relationship between the graph of a function and its image under one or more transformations
- OC3.01 explain mathematical processes, methods of solution, and concepts clearly to others
- OC3.04 demonstrate the correct use of mathematical language, symbols, visuals (e.g., diagrams, graphs), and conventions

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Time Required Functions and Relations or Functions: 45–60 min

Materials and Equipment

- graphing calculator
- graphing software

Overview

This *Performance Task* allows students to demonstrate that they can

- explore the concept of a function and use appropriate notation
- illustrate the relationship between the graph of a function and its image under transformations
- solve problems involving functions
- use technology as an aid in problem solving
- solve multi-step problems
- report the solution to a problem clearly and concisely, using appropriate mathematical forms

Description of Task

This *Performance Task* requires students to create two relations to model two different pricing systems. Then they must decide which company offers the better deal.

Management Suggestions

Pairs or individuals could do this *Performance Task*.

Assessment Suggestions

Assess Achievement using the rubric for this *Performance Task*. If students work in pairs, also assess their problem-solving skills by observing students as they work. Assess communication skills by evaluating written solutions or by asking students questions as they work.

Assess the Learning Skills Organization using the related generic rubric. (See Assessment and Evaluation in the *Teacher Resource*.)

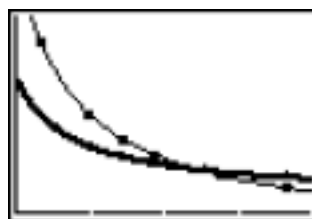
Guidelines for Solution

Part (a)

Number on Trip	30	40	50	75	100
Cost per Person	\$533.33	\$450	\$400	\$333.33	\$300

Part (b)

In the screen, the thicker line of best fit represents the data for Straight-Away Charters and the other represents the data for Fly-Rite.



Part (c)

For Fly-Rite, the cost per person is higher for fewer students, while, for Straight-Away Charters, the cost per person is more expensive for more students.

Part (d)

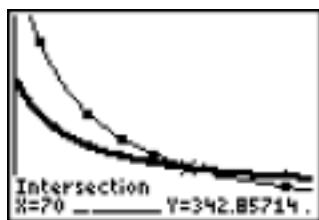
Both relations could be modelled by $y = \frac{1}{x}$.

For Fly-Rite, the product of the number on the trip and the cost per person is 24 000. Then $xy = 24\,000$, where x is the number of students on the trip and y is the cost per person. Solving for y yields $y = \frac{24\,000}{x}$.

For Straight-Away Charters, the total cost is about $\$10\,000 + \$200x$, where x is the number of students on the trip. But the relation must represent the cost per student. Since x students are going on the trip, $y = \frac{10\,000 + 200x}{x}$ or $y = \frac{10\,000}{x} + 200$.

Part (e)

The screen indicates that the cost per person is about \$342.86 if 70 students go on the trip



Algebraically, the values of x and y must be the same. Substitute and then solve for x .

$$\frac{24\,000}{x} = \frac{10\,000}{x} + 200 \quad \text{Multiply by } x.$$

$$24\,000 = 10\,000 + 200x$$

$$x = 70$$

Therefore, if 70 students go on the trip, the cost per person will be equal.

Part (f)

If the cost per person increases to \$250, then the Straight-Away equation becomes

$$y = \frac{10\,000}{x} + 250 \text{ and the graph would be}$$

translated vertically up 50 units.

Part (g)

For the new rate, the intersection point changes. The cost per person is equal when the number of students is 56. In this case, Fly-Rite offers a better deal when more than 56 students go on a trip and Straight-Away offers a better deal when fewer than 56 students go on a trip.

Performance Task #7 — Fractals (Functions and Relations)

Specific Expectations

Unless stated otherwise, the following expectations are common to the Functions and Relations course and the Functions course.

- OC1.04 identify the structure of the complex number system and express complex numbers in the form $a + bi$, where $i^2 = -1$ (e.g., $4i$, $3 - 2i$)
- OC1.06(U) add, subtract, multiply, and divide complex numbers in rectangular form
- OC2.02 demonstrate facility in the use of function notation for substituting into and evaluating functions
- OC3.03 communicate solutions to problems and to findings of investigations clearly and concisely, orally and in writing, using an effective integration of essay and mathematical forms
- OC3.04 demonstrate the correct use of mathematical language, symbols, visuals (e.g., diagrams, graphs), and conventions

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Time Required Functions and Relations or Functions: 45–60 min (Extension will require time outside of class.)

Overview

This *Performance Task* allows students to demonstrate that they can

- explore the concept of a function and use appropriate notation
- explore complex numbers
- solve multi-step problems
- report the solution to a problem clearly and concisely, using appropriate mathematical forms

Description of Task

This *Performance Task* requires students to use complex numbers to generate fractals and some students may want to further explore fractal geometry. This *Performance Task* is most appropriate for students in the Functions and Relations course, or it can be an extension activity for students in the Functions course.

Management Suggestions

Students could work individually on this *Performance Task*. Small groups could explore the Extension.

Assessment Suggestions

Assess Achievement using the rubric for this *Performance Task*. Also assess by observing students at work and by examining written responses.

Assess the Learning Skill Independence by observing how well students who are working individually understand the problem and complete a solution. Assess the Learning Skill Initiative of students who do the Extension.

EXTENSION

For students who have written computer programs, ask them to write a computer program to generate fractal patterns, which they might present to the class.

Guidelines for Solution

Solutions will include accurate and complete solutions. Good use of function notation should be evident.

Part (a)

The first three iterates are $f(2) = 3$, $f(3) = 8$, and $f(8) = 63$.

Part (b)

The first iteration is

$$\begin{aligned} f(2 + 3i) &= (2 + 3i)^2 + (-1 + 2i) \\ &= 4 + 12i + 9i^2 - 1 + 2i \\ &= -6 + 14i \end{aligned}$$

The second iteration should show that $f(-6 + 14i) = -161 - 166i$.

The third iteration should show that $f(-161 - 166i) = -1636 + 53\,454i$.

Part (c)

Solve a complex equation.

$$-7 + 5i = 2z + 4i - 5$$

$$-2 + i = 2z$$

$$-1 + 0.5i = z$$

Therefore, the initial value was $-1 + 0.5i$.

Performance Task #8 — Presenting Math

Specific Expectations

The following expectations are common to the Functions and Relations course and the Functions course.

- OC2.03 determine, through investigation, the properties of the functions defined by $f(x) = \sqrt{x}$ [e.g., domain, range, relationship to $f(x) = x^2$] and $f(x) = \frac{1}{x}$ [e.g., domain, range, relationship to $f(x) = x$.];
- OC2.06 represent transformations (e.g., translations, reflections, stretches) of the functions defined by $f(x) = x$, $f(x) = x^2$, $f(x) = \sqrt{x}$, $f(x) = \sin x$, and $f(x) = \cos x$, using function notation
- OC2.07 describe, by interpreting function notation, the relationship between the graph of a function and its image under one or more transformations
- OC3.01 explain mathematical processes, methods of solution, and concepts clearly to others
- OC3.02 present problems and their solutions to a group, and answer questions about the problems and the solutions
- OC3.04 demonstrate the correct use of mathematical language, symbols, visuals (e.g., diagrams, graphs), and conventions
- OC3.05 use graphing technology effectively (e.g., use appropriate menus and algorithms; set the graph window to display the appropriate section of a curve)

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Time Required Functions and Relations or Functions: 70–100 min

Materials and Equipment

- large graph paper or overhead transparency
- graphing calculator or graphing software

Overview

This *Performance Task* allows students to demonstrate that they can

- determine properties of several basic functions
- describe the properties of functions under transformations
- describe the relationship between the graph of a function and its image under transformations
- use technology as an aid in problem solving
- report the solution to a problem clearly and concisely, using appropriate mathematical forms

Description of Task

This *Performance Task* requires students to create a presentation that will clearly show what they have learned about transformations. Students could use graphing technology and

visuals to create the presentations. Students should also use correct mathematical language to describe the transformations.

Management Suggestions

Small groups of two to three students in each group could do this *Performance Task*. Although a presentation is the suggested format, students could also write a few paragraphs or create a poster.

Assessment Suggestions

Assess Achievement using the rubric for this *Performance Task*. Invite students to assess their peers using the Communication category of the rubric.

Assess the Learning Skills Teamwork and Initiative using the related generic rubrics. Or distribute the Learning Skills Self-Assessment Checklists and ask students to fill out the Teamwork and Initiative sections. (See Assessment and Evaluation in the *Teacher Resource*.)

Guidelines for Solution

Solutions will vary greatly, but the presentations should clearly include all of the necessary transformations.

Performance Task #9 — Demonstrating Math

Specific Expectations

Unless stated otherwise, the following expectations are common to the Functions and Relations course and the Functions course.

- OC1.02 add, subtract, and multiply polynomials
- OC1.03 determine the maximum or minimum value of a quadratic function whose equation is given in the form $y = ax^2 + bx + c$, using the algebraic method of completing the square
- OC1.05 determine the real or complex roots of quadratic equations, using an appropriate method (e.g., factoring, the quadratic formula, completing the square), and relate the roots to the x -intercepts of the graph of the corresponding function
- OC1.07(U)/OC1.06(U/C) add, subtract, multiply, and divide rational expressions, and state the restrictions on the variable values
- OC3.01 explain mathematical processes, methods of solution, and concepts clearly to others
- OC3.02 present problems and their solutions to a group, and answer questions about the problems and the solutions
- OC3.04 demonstrate the correct use of mathematical language, symbols, visuals (e.g., diagrams, graphs), and conventions
- OC3.05 use graphing technology effectively (e.g., use appropriate menus and algorithms; set the graph window to display the appropriate section of a curve)

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Time Required Functions and Relations or Functions: 60–120 min

Materials and Equipment

- chart paper or overhead transparency
- presentation software

Overview

This *Performance Task* allows students to demonstrate that they can

- demonstrate facility in manipulating polynomials, rational expressions
- extend the understanding of a quadratic function
- use technology as an aid in problem solving
- solve multi-step problems
- report the solution to a problem clearly and concisely, using appropriate mathematical forms

Description of Task

This *Performance Task* requires students to explain and to demonstrate how to use quadratic modelling to solve problems.

Management Suggestions

Students could work in pairs on this *Performance Task*.

Assessment Suggestions

Assess Achievement using the rubric for this *Performance Task*. Students must communicate to explain the solutions to the problems, integrate algebraic and graphical forms, and use correct mathematical notation. Students could assess other students' skills for a portion of this *Performance Task*.

Assess the Learning Skills Teamwork if students are working in small groups, using the related generic rubric. Or distribute the Learning Skills Self-Assessment Checklists and ask students to fill out the Teamwork section. (See Assessment and Evaluation in the *Teacher Resource*.)

Guidelines for Solution

Student presentations' will vary, but they should include diagrams, algebraic solutions, and graphical solutions. Students should verify their solutions. The rubric outlines all of the necessary components.

Part (a)

Solutions should include diagrams and a graph.

$A = x\left(\frac{800 - 5x}{2}\right)$, where A is the area of the

rectangular field and x is the width of each parallel side. Expand this equation and complete the square to get

$$A = -2.5(x - 80)^2 + 16\,000.$$

The maximum area is 16 000 m² if each of the five parallel sides is 80 m and the other two sides are each 200 m.

Part (b)

Solutions should include a graph.

$R = (80 + x)(200 - 2x)$, where R is the revenue and x is the number of passengers over 80 passengers. Expand this equation and complete the square to get

$R = -2(x - 10)^2 + 16\,200$. The greatest revenue of \$16 200 occurs when there are 10 more passengers, in other words, when there are 90 passengers in total.

Performance Task #10 — How Fast?

Specific Expectations

Unless stated otherwise, the following expectations are common to the Functions and Relations course and the Functions course.

- OC1.02 add, subtract, and multiply polynomials
- OC1.03 determine the maximum or minimum value of a quadratic function whose equation is given in the form $y = ax^2 + bx + c$, using the algebraic method of completing the square
- OC1.05 determine the real or complex roots of quadratic equations, using an appropriate method (e.g., factoring, the quadratic formula, completing the square), and relate the roots to the x -intercepts of the graph of the corresponding function
- OC1.07(U)/OC1.06(U/C) add, subtract, multiply, and divide rational expressions, and state the restrictions on the variable values
- OC3.01 explain mathematical processes, methods of solution, and concepts clearly to others
- OC3.02 present problems and their solutions to a group, and answer questions about the problems and the solutions
- OC3.04 demonstrate the correct use of mathematical language, symbols, visuals (e.g., diagrams, graphs), and conventions
- OC3.05 use graphing technology effectively (e.g., use appropriate menus and algorithms; set the graph window to display the appropriate section of a curve)

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Time Required Functions and Relations or Functions: 60 min

Materials and Equipment

- chart paper or overhead transparency
- presentation software

Overview

This *Performance Task* allows students to demonstrate that they can

- demonstrate facility in manipulating polynomials, rational expressions
- extend the understanding of a quadratic function
- use technology as an aid in problem solving
- solve multi-step problems
- report the solution to a problem clearly and concisely, using appropriate mathematical forms

Description of Task

This *Performance Task* requires students to explain and to demonstrate how to use quadratic modelling to solve problems.

Management Suggestions

Students could work in pairs on this *Performance Task*.

Assessment Suggestions

Assess Achievement using the rubric for this *Performance Task*. Students must communicate to explain the solutions to the problems, integrate algebraic and graphical forms, and use correct mathematical notation. Students could assess other students' skills for a portion of this *Performance Task*.

Assess the Learning Skills Teamwork if students are working in small groups, using the related generic rubric. Or distribute the Learning Skills Self-Assessment Checklists and ask students to fill out the Teamwork section. (See Assessment and Evaluation in the *Teacher Resource*.)

Guidelines for Solution

Student presentations' will vary, but they should include diagrams, algebraic solutions, and graphical solutions. Students should verify their solutions. The rubric outlines all of the necessary components.

Draw a table where x represents time.

	Distance	Speed	Time
Kim	150 km	$\frac{150}{x}$	x
Julie	150 km	$\frac{150}{x-1.25}$	$x - 1.25$

The difference between their speeds is 20 km/h, and the equation is

$$\frac{150}{x} + 20 = \frac{150}{x-1.25}$$

The solution of this

equation will produce the result that Kim was travelling at 40 km/h and Julie was travelling at 60 km/h. A graphical solution should show that the required times will be the x -intercepts of the function.