GRADE 9 & 10 MATH

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GRADE 9 & 10

MEETING THE EXPECTATIONS

CW Physics, Science & Math Day Activities

A correlation with the Ontario Mathematics Curriculum, Grade 9

Activity	9 Applied Expectations	9 Academic Expectations
Money, Money, Money	Number Sense and Algebra 1 → solve problems involving proportional reasoning using a variety of strategies 3 → demonstrate facility in operations with rational numbers as necessary to support other topics of the course 5 → recognize and represent, directly proportional relationships arising from realistic situations 10 → demonstrate facility in expressing percents, fractions and decimals in their equivalent forms and apply as needed for solving problems 11 → solve problems involving ratio, rate, and percent in topics arising from real life using a variety of tools and methods Modeling Relationships 20 → determine the characteristics of linear relationships 28 → construct tables of values, graphs, and equations to represent linear relations derived from descriptions of realistic situations 40 → describe the effect on the graph and make the corresponding changes to the equation when the conditions of the situation they represent are varied 41 → solve problems involving two linear relations which represent realistic situations by determining graphically and interpreting the point of intersection	Modeling Relationships 14 → demonstrate an understanding of the characteristics of a linear relationship 21 → construct tables of values, graphs, and equations to represent linear relations derived from descriptions of realistic situations 40 → describe the effect on the graph and the equation when the conditions of a situation they represent are varied

Activity	9 Applied Expectations	9 Academic Expectations
Testing, Testing, 1-2-3	Modeling Relationships 19 → determine relationships between two variables 23 → interpret the meaning of points on a scatter plot 24 → pose problems, identify variables, and formulate hypotheses associated with relationships and design an experiment to test it 26 → collect and organize data, using appropriate equipment and/or technology and techniques 27 → describe trends and relationships observed in data, make inferences from data, compare the inferences with hypotheses about the data, and explain the differences between the inferences and the hypotheses	Modeling Relationships 13 → determine relationships between two variables 16 → interpret the meaning of points on a scatter plot 17 → pose problems, identify variables, and formulate hypotheses associated with relationships and design an experiment to test it 19 → collect and organize data, using appropriate equipment and/or technology and techniques 20 → describe trends and relationships observed in data, make inferences from data, compare the inferences with hypotheses about the data, and explain the differences between the inferences and the hypotheses
Food For Thought	Number Sense and Algebra 1 → solve problems involving proportional reasoning 6 → solve problems involving direct proportions using a variety of methods in contexts arising within the course 7 → make comparisons using unit rates 8 → determine the constant of proportionality in situations which are direct variations, connect the constant of proportionality to rate, and use this to solve problems Measurement and Geometry Strand 44 → solve problems involving the measurement of two-dimensional figures and the volume of three-dimensional figures 52 → solve problems involving the volume of prisms, pyramids, cylinders, cones, and spheres	Measurement and Geometry Strand 49 → solve problems involving area of plane figures and the surface area and volume of three-dimensional objects 57 → solve problems involving the surface are and volume of prisms, pyramids, cylinders, cones, and spheres, including composite figures

MEETING THE EXPECTATIONS Grade 9

Activity	9 Applied Expectations	9 Academic Expectations
Just Measure It!	Number Sense and Algebra 1 → solve problems involving proportional reasoning using a variety of strategies 11 → solve problems involving ratio, rate, and percent in topics arising from real life using variety of tools and methods 12 → draw and interpret scale diagrams arising from real situations	
The Mathemagical Kingdom – The Right Price	Modeling Relationships 20 → determine the characteristics of linear relationships 21 → demonstrate an understanding of constant rate of change and its connection to linear relationships 22 → describe the connections between various representations of a linear relation and solve problems using the representations 28 → construct tables of values, graphs, and equations to represent linear relations derived from descriptions of realistic situations, using a variety of tools 35 → express linear relationships as an equation in two variables using the rate of change and the initial value 37 → solve problems involving linear relationships by using the equation of the relation and by interpolating and extrapolating from the graph of the relation 39 → determine other representations of a linear relation given one representation 41 → solve problems involving two linear relations which represent realistic situation by determining graphically and interpreting the point of intersection	Modeling Relationships 14 → demonstrate an understanding of the characteristics of a linear relationship 15 → describe the connections between the various representation of a linear relationship 21 → construct tables of values, graphs, and equations to represent linear relations derived from descriptions of realistic situations, using a variety of tools 26 → determine values of a linear relation given a table of values and by using the equation of the relation and by interpolating or extrapolating from the graph of the relation 29 → determine other representations of a linear relation given one representation

Activity	9 Applied Expectations	9 Academic Expectations
The Mathemagical Kingdom – Down by the Bay	Modeling Relationships 19 → Determine relationships between two variables 23 → Interpret the meaning of points on a scatter plot 24 → Pose problems, identify variables, and formulate hypotheses associated with relationships and design an experiment to test it 27 → Describe trends and relationships observed in data, make inferences from data, compare inferences with hypotheses about the data, and explain the differences between the inferences and the hypotheses Measurement and Geometry 43 → Determine the optimal values of various measurements 46 → Construct a variety of rectangles for a given perimeter using a variety of tools 48 → Solve problems requiring maximizing the area or minimizing the perimeter	Modeling Relationships 13 → Determine relationships between two variables 16 → Interpret the meaning of points on a scatter plot 17 → Pose problems, identify variables, and formulate hypotheses associated with relationships and design an experiment to test it 20 → Describe trends and relationships observed in data, make inferences from data, compare inferences with hypotheses about the data, and explain the differences between the inferences and the hypotheses Measurement and Geometry 48 → Determine the optimal values of various measurements 52 → Explain the significance of optimal area, surface area or volume in various applications 53 → Pose and solve problems involving maximization and minimization of geometric figures
The Mathemagical Kingdom – Scale Diagrams	Number Sense and Algebra 1 → solve problems involving proportional reasoning using a variety of strategies 11 → Solve problems involving ratio, rate, and percent in topics arising from real life using variety of tools and methods 12 → Draw and interpret scale diagrams arising from real situations	

CW Physics, Science & Math Day Activities

A correlation with the Ontario Mathematics Curriculum, Grade 10

Activity	10 Applied Expectations	10 Academic Expectations
Up, Up, & Away	Measurement and Trigonometry 1 → solve problems by applying the properties of similar triangles 2 → use trigonometry involving right angled triangles to solve problems in real life situations 6 → determine the lengths of sides of similar triangles using proportions 7 → solve problems involving similar triangles in realistic situations 9 → determine the measures of the sides and angles in right triangles, using the primary trigonometric ratios 10 → solve problems, in real life applications, involving the measures of sides and angles in right triangles, using the primary trigonometric ratios and the Pythagorean Theorem	Measurement and Trigonometry 41 → use their knowledge of ratio and proportion to investigate similar triangles and solve problems related to similarity 42 → solve problems involving right triangles using the primary trigonometric ratios 46 → solve problems involving similar triangles in realistic situations 48 → determine the measures of the sides and angles in right triangles, using the primary trigonometric ratios 49 → solve problems involving the measures of sides and angles in right triangles using trigonometric ratios
Drop Tower	Quadratic Relationships 1 → determine the basic properties of quadratic relationships 2 → relate the transformations to the graph of $y=x^2$ to the algebraic representation of $y=a(x-p)^2+q$ 3 → solve quadratic equations and interpret the solutions with respect to the corresponding relationships 4 → solve problems involving quadratic relationships 6 → explore and describe the nature of change in a quadratic relationship, using finite differences in tables of values, and compare the nature of change in a quadratic relationship with the nature of change in a linear relationship	

Drop Tower	7 → identify the co-ordinates of the vertex and the equation of the axis of symmetry from the graph of a parabola 12 → determine the equation, in the form $y=a(x-h)^2+k$ 20 → solve quadratic equations which have real roots, using the quadratic formula, and by using graphing calculators or graphing software 22 → determine the zeros and the maximum or minimum value of a quadratic relationship from its graph, using graphing calculators or graphing software, and by applying algebraic techniques on the defining equation, when appropriate 23 → solve problems, with and without technology, arising from a realistic situation represented by a graph or an equation of a quadratic relationship	
The Mathemagical Kingdom – It's the Sign that Counts	Measurement and Trigonometry 2 → Use trigonometry involving right angled triangles to solve problems in real life situations 9 → Determine the measures of the sides and angles in right triangles, using the primary trigonometric ratios 10 → Solve problems, in real life applications, involving the measures of sides and angles in right triangles	Trigonometry 42 → Solve problems involving right triangles using the primary trigonometric ratios 48 → Determine the measures of the sides and angles in right triangles, using the primary trigonometric ratios 49 → Solve problems involving the measures of sides and angles in right triangles using trigonometric ratios

Activity	10 Applied Expectations	10 Academic Expectations
The Mathemagical Kingdom – Peaking Profits	Modeling Relationships 19 → identify the characteristics of quadratic relationships and solve problems related to quadratic models 41 → identify the vertex, direction of opening, the equation of the axis of symmetry, and stretch of compression factor of a quadratic relation when the equation is given in the form $y=a(x-h)^2+k$ and sketch the corresponding parabola 42 → determine the y-intercept, the zeros and the maximum or minimum value of a quadratic relation from its graph, using graphing calculators or graphing software as needed 44 → solve problems involving a given quadratic relation by interpreting its graph using a graphing calculator or graphing software	Quadratic Relationships 1 → determine the basic properties of quadratic relationships 2 → relate the transformations to the graph of $y=x^2$ to the algebraic representations $y=a(x-p)^2+q$ 4 → solve problems involving quadratic relationships 7 → identify the coordinates of the vertex and the equation of the axis of symmetry from the graph of a parabola 11 → explain the role of a, h, and k in $y=a(x-h)^2+k$ using appropriate mathematical vocabulary, and identify the vertex and the equation of the axis of symmetry 17 → solve quadratic equations which have real roots, using the quadratic formula, and by using graphing calculators or graphing software 22 → determine the zeros and the maximum or minimum value of a quadratic relationship from its graph, using graphing calculators or graphing software, and by applying algebraic techniques on the defining equation, when appropriate 23 → solve problems, with and without the technology, arising from a realistic situation represented by a graph or an equation of a quadratic relationship

GRADE 9 & 10

STUDENT ACTIVITIES

Money, Money, Money

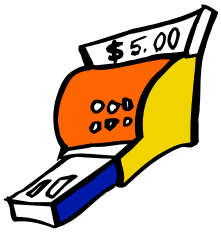
Testing, Testing, 1-2-3

Food for Thought

Up, Up, & Away

Just Measure It!

Drop Tower



Before the Park

1. What is the cost of _____ in your school's cafeteria?

2. Estimate the number of _____ sold in one year in your school's cafeteria.

Required Information	Estimates and Calculations

3. Estimate the amount of money spent on _____ in one year in your school's cafeteria.

At the Park

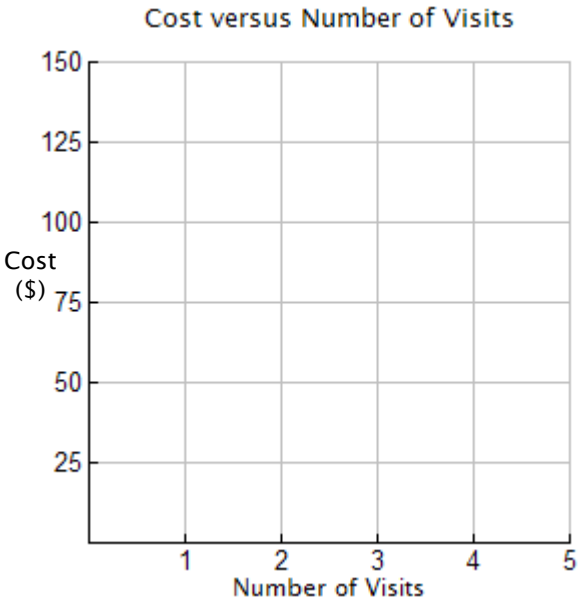
1. What is the cost of a "Pay-One-Price Passport"?

2. What is the cost of a "Season Pass"?

3. Complete the following tables.
   Graph the "Pay-One-Price Passport" data on the grid below.
   Using a different colour, graph the "Season Pass" data on the grid below too.

Pay-One-Price Passport	
# of visits	Cost ($)
0	
1	
2	
3	
4	
5	

Season Pass	
# of visits	Cost ($)
0	
1	
2	
3	
4	
5	



4. Complete each of the following sentences.

A customer should choose a "Pay-One-Price Passport" if …	A customer should choose a "Season Pass" if …

5. ***If*** Canada's Wonderland changes the cost of a Season Pass to $95, how will the graph of the cost of a Season Pass versus number of visits change?

6. ***If*** Canada's Wonderland changes the cost of a Pay-One-Price Passport to $60, how will the graph of the cost of a Pay-One-Price Passport versus number of visits change?

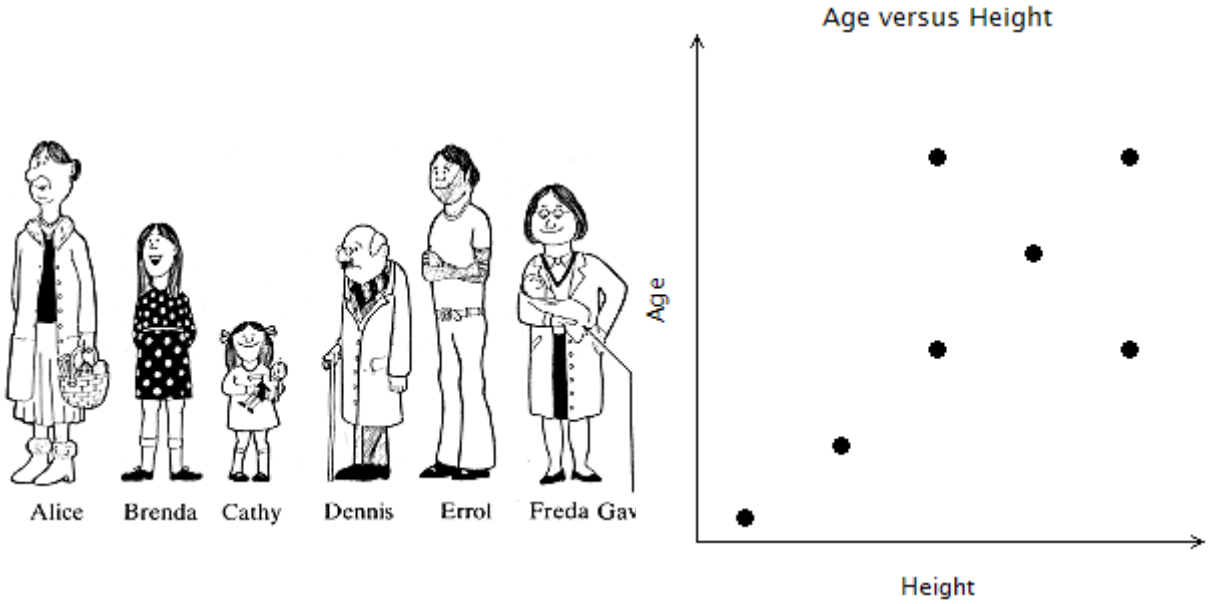
7. Select a ride at Canada's Wonderland. _____
   Estimate the number of passengers that could go on this ride in one season.

Required Information	Estimates and Calculations

Before the Park

1. Hypothesis
   Do you think that there is a relationship between the age of a person and the height of a person? Explain your reasoning.

2. Model
   Who is represented by each point on the scatter plot below?



3. Infer/Conclude
   a) Does a relationship seem to exist the age and the height of the people?
   Explain your reasoning.

   b) Is this outcome consistent with your original hypothesis?
   Explain any differences between your conclusion in a) and your original hypothesis.

   c) Circle any outliers on the scatter plot above.
   Provide an explanation for the existence of each outlier.

At the Park

Does the length of the wait for a ride depend on the age of the ride?

Explore:

1. As you move through the Park today, time the wait for the following rides.
2. Record the length of the wait (to the nearest minute) in the table below.

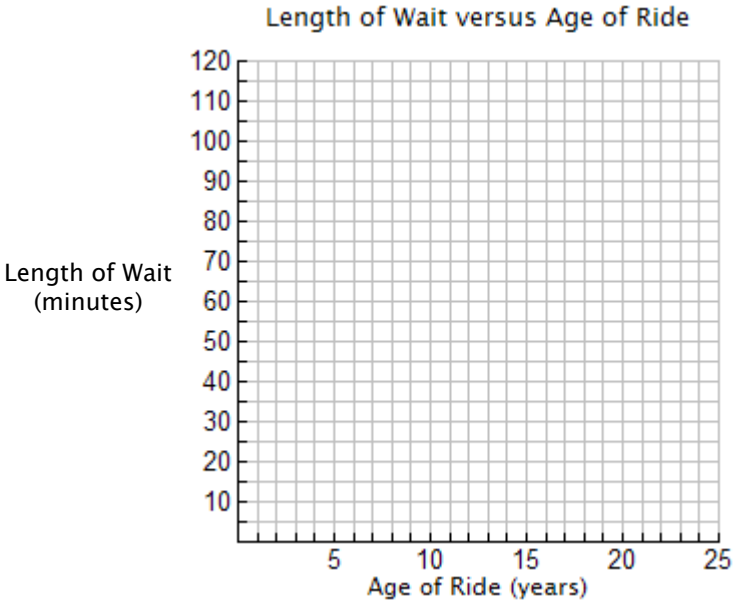
Ride	Year Opened	Age of Ride (years)	Length of Wait (minutes)
Time Warp	2004		
Sledge Hammer	2003		
Psyclone	2002		
Shockwave	2001		
Riptide	2000		
Drop Tower	1997		
The Fly	1999		
Flight Deck	1995		
Vortex	1991		
The Bat	1987		
Skyrider	1984		
Dragon Fire	1981		
Mighty Canadian Minebuster	1981		
Wild Beast	1981		
Thunder Run	1986		
Jet Scream	1990		

Hypothesize:

Do you think that the length of the wait for a ride depends on the age of the ride?
(Use your intuition and the data from the table to make a hypothesis.)

Model/Formulate:

Construct a scatter plot of the length of the wait versus the age of the ride.
If possible, draw a line of best fit for this data.



Infer/Conclude:

a) Does a relationship seem to exist between the length of the wait and the age of the ride?
Explain your reasoning.

b) Is this outcome consistent with your original hypothesis?
Explain any differences between your conclusion in a) and your original hypothesis.

c) Circle any outliers on the scatter plot above.
Provide an explanation for the existence of each outlier.

d) Canada's Wonderland is always looking to improve the Park.
Explain 3 changes that you would make to the Park based on your observations.

Before the Park

NOTE Prices have been listed for the purpose of this activity and do not accurately reflect operational procedures or prices in the Park.

Ristorante Pizza Pizza at Canada's Wonderland sells small and large pizzas.

1. The small pizzas are 15 cm in diameter and sell for $6.50.
   a) Sketch the small pizza and label its diameter.

   b) Calculate the area of the pizza.

   Area of a circle $= \pi r^2$

   c) Calculate the unit cost for a small pizza.

2. The large pizzas are 30 cm in diameter and sell for $13.
   Is the small pizza or the large pizza a better buy? Explain your reasoning.
   Use words, diagrams, numbers, and calculations to support your answer.

At the Park

1. a) Find a restaurant or stand that sells drinks in (approximately) cylindrical containers.

What is the name of this restaurant/stand? _____

Where is this restaurant/stand located? _____

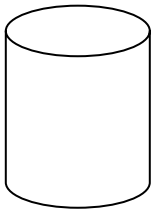
b) What is the cost of this drink?

Cost = _____

c) Estimate the height and the diameter of the cylindrical container.

Height = _____ Diameter = _____

d) Label these dimensions on the sketch below.



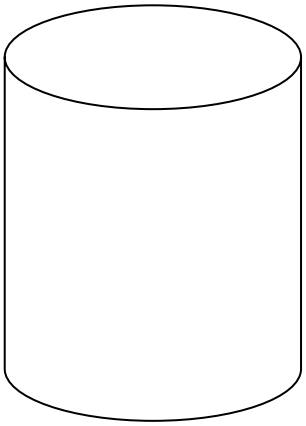
e) Calculate the volume of this cylindrical drink container.

Volume of a cylinder$=\pi r^2 h$

f) Calculate the unit price of this drink.

NOTE "Super-size drink" is for the purpose of this activity and does not accurately reflect operational procedures of Canada's Wonderland.

2. Next year, Canada's Wonderland plans to introduce a new "super-size" drink.
   To create the new "super-size" container, CW will be double the diameter and radius above.
   a) Label the dimensions on the sketch of the "super-size" container below.

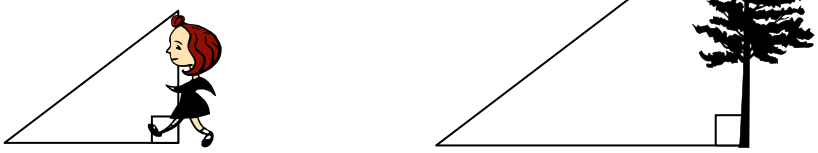


   b) Calculate the volume of the "super-size" drink container.

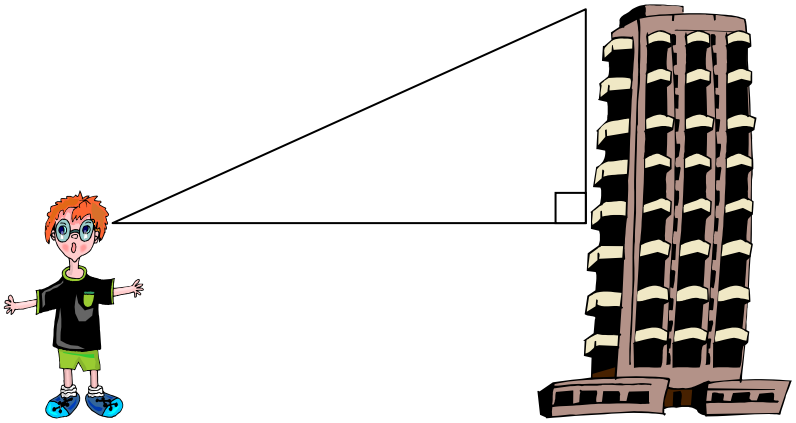
   c) How much should CW charge for this new "super-size" drink?
   Explain your reasoning.

Before the Park

1. A 175 cm tall student casts a shadow that is 2.3 m long.
   At the same time, a tree casts a shadow that is 8.2 m long.
   How tall is the tree?



2. A 180 cm tall student is 110 m from a building.
   The student measures the angle of elevation to the top of the building is 40°.
   How tall is the building?



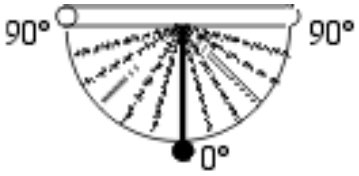
Before the Park

Making a Clinometer

In this activity, you will build a clinometer.
A clinometer is a device that will allow you to calculate the heights of various objects.

Materials:

- a drinking straw
- a semi-circle of cardboard
- a piece of string
- a weight (a washer or several paper clips will suffice)
- tape



Procedure:

1. Draw a baseline along the bottom edge of the cardboard, and mark the centre.

2. Use a protractor to mark the cardboard into degrees (see diagram).
   Mark from 90° to 0° to 90° with zero at the bottom of the curve.

3. Tape the straw along the straight edge (top) of the semicircle.

4. Tape the string to the centre of the straight edge of the semicircle. Attach a weight to the string.

At the Park

Using Shadows to Find the Height of a Tall Object

1. Select a tall object at Canada's Wonderland. _____
   You might choose a light post, a tree, a ride, a building or any other tall object.
   You will need to measure the length of the shadow of this object, so choose the object wisely.

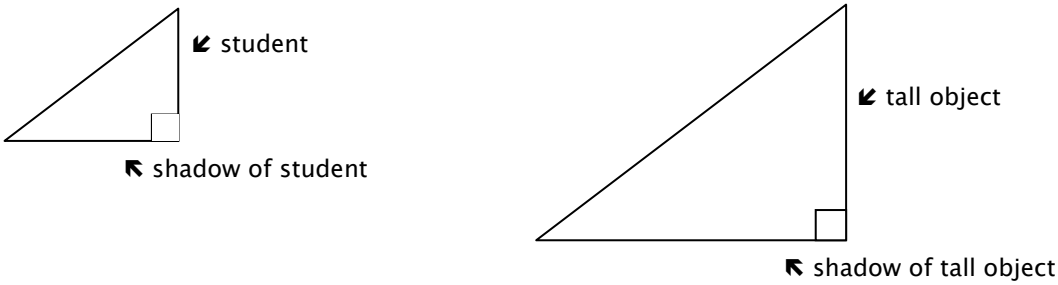
2. Measure the length of the object's shadow. _____

3. Select a student in your group. _____

   Measure the height of that student. _____

   Measure the length of that student's shadow. _____

4. Label the diagram below.



5. Explain why the two triangles are similar.

_____

_____

_____

6. Calculate the height of the tall object. Show your work

At the Park

Using a Clinometer to Find the Height of a Tall Object

1. Select another tall object at Canada's Wonderland. _____
   You might choose a light post, a tree, a ride, a building or any other tall object.
   You will need to measure your distance to the base of this object, so choose the object wisely.

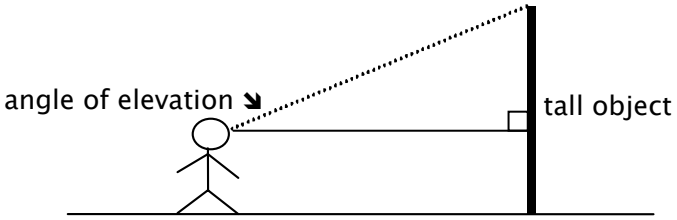
2. Hold the clinometer at eye level and sight the top of the object by looking through the straw.

3. Ask a partner to read the angle on the clinometer (where the string is touching).
   Record this value.
   Angle of elevation = _____

4. Measure the distance between where you are standing and the base of the object.
   Record this value.
   Distance to base of object = _____

5. Measure the distance from your eyes to the ground.
   Record this value.
   Distance to from your eyes to the ground = _____

6. Complete the diagram below of you and the tall object by adding the values you recorded.



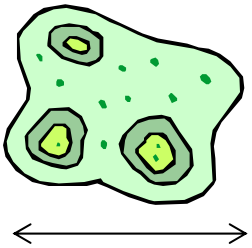
7. Calculate the height of the tall object. Show your work.

Before the Park

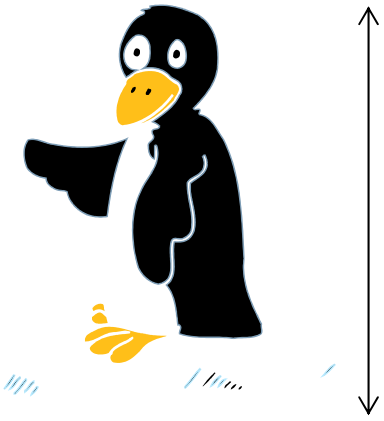
A scale diagram is a drawing that is an enlargement of a small object or a reduction of a large object.
A scale is the ratio of the diagram measurement to the actual measurement.

scale = diagram measurement : actual measurement

1. **This cell is actually 0.3 mm across.**
   What scale was used to draw this diagram?



2. **This diagram was drawn using a scale of 1:7.**
   What is the actual height of this penguin?



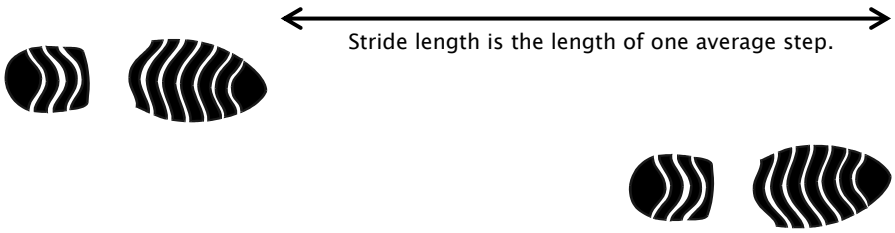
3. **Complete the table.**

	Scale	Diagram Measurement	Actual Measurement
a)	1:400	6 cm	(in metres)
b)		7.2 cm	0.6 mm
c)	1:250000	8 cm	(in kilometres)

At the Park

1. Select a student in your group. _____

   Measure their stride length. _____



2. Using the map, identify five distances that you could measure by walking in a straight line. Then, for each distance:
   a) Measure the distance in steps.
   b) Use the average length of your step to estimate the actual distance.
   c) Use a ruler to measure the distance on the map.
   d) Record the results in the table below.

From	To	Number of Steps	Actual Distance (m)	Map Distance (cm)

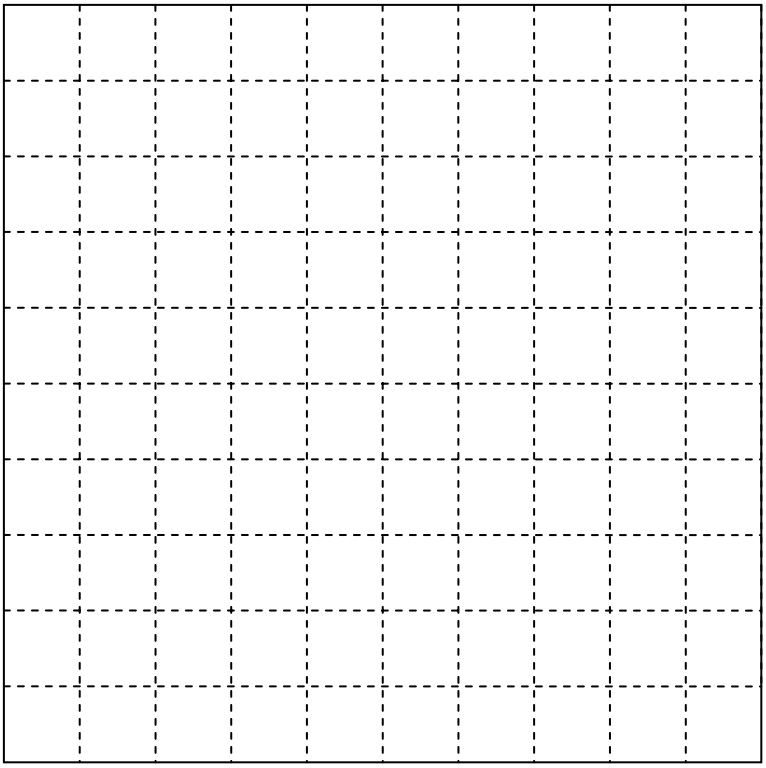
3. Using the information in the table, estimate the scale of the map.
   Explain your reasoning.

At the Park

1. Visit one of the miniature golf courses at Canada's Wonderland.
   - Pro-Putt Mini Golf* is located in the White Water Canyon Area.
   - City Zoo Mini-golf* is located in Hanna-Barbera Land.

   * Please note that these are PAY-AS-YOU-PLAY attractions.

2. Choose one hole from the course.
   Use a scale of 1:50 to draw a scale diagram of the hole.
   (Include the dimensions of the hole on the diagram.)



3. Calculate the ratio the area of all obstacles to the area of the green.

Before the Park

The high diving board at the local pool has a height of 8 meters.
Your friend has decided to dive off the high diving board while you record their distance above the water.

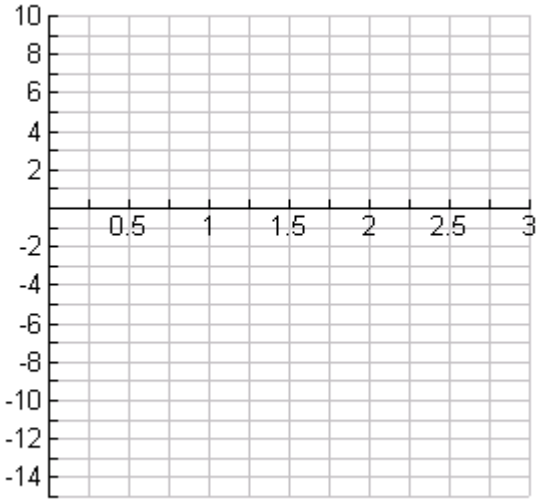
1. Complete the table to find out the rate at which your friend falls during the first two seconds. (We are assuming there is no air resistance, which would have a slowing down effect.)

Time (seconds)	Distance from the Water (meters)	First Differences	Second Differences
0	8.0		
0.5	6.75		
1.0	3.0		
1.5	-3.25		
2.0	-12.0		

2. What can you determine about this function from the First Differences column? Explain.

3. What can you determine about this function from the Second Differences column? Explain.

4. Display the data from the table on the grid below.



5. Determine the coordinates of the vertex of this function.

6. Determine the equation of this function.

7. Determine the zeros of this function. What do the zeros of this function represent?

8. For how long is your friend at a height of at least 1.6 m above the water?

At the Park

If you drop a large cannonball and a small cannonball from the top of a building at the same time, which would hit the ground first?

Aristotle believed that an object with greater mass would fall faster than an object will smaller mass. In the sixteenth century, Galileo performed an experiment at the Leaning Tower of Pisa to prove that the cannon balls would reach the ground at the same time, regardless of their mass. Aristotle was wrong!

1. Using a watch, determine how long it takes for the ride DROP ZONE to start at a height of 62.8m and free-fall for 40.26m. _____

   When an object is in free-fall, it accelerates at a rate of 9.8 m/s^2.
   That is, the object's velocity increases 9.8 m/s every second.

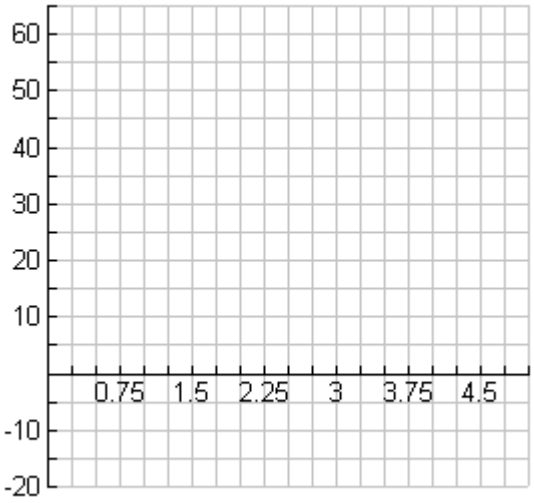
2. Complete the table to find out the rate at which an object falls during the first four seconds. (We are assuming there is no air resistance, which would have a slowing down effect.)

Time (seconds)	Distance from the Ground (meters)	First Differences	Second Differences
0	62.8		
0.5	61.575		
1.0	57.9		
1.5	51.775		
2.0	43.2		
2.5	32.175		
3.0	18.7		
3.5	2.775		
4.0	-15.6		

3. What can you determine about this relation from the First Differences column? Explain.

4. What can you determine about this relation from the Second Differences column? Explain.

5. Display the data from the table on the grid below.



6. Determine the coordinates of the vertex of this function.

7. Determine the equation of this function.

8. Determine the zeros of this function. What do the zeros of this function represent?

9. For how long is the ride at a height of at least 22.54 m? Show your work.

10. How does this information relate to the information you recorded from the ride?

GRADE 9 & 10

SUMMATIVE ASSESSMENT

The Right Price

Down by the Bay

Scale Diagrams

It's the Sign that Counts

Peaking Profits

Please note that this section has been created for purposes of this manual. It does not accurately reflect operational procedures or prices of Canada's Wonderland.

The Mathemagical Kingdom

- Canada's Wonderland is currently divided into 9 thematic areas:
  - Medieval Faire
  - Hanna-Barbera Land
  - International Festival
  - World Exposition of 1890
  - International Street
  - Splash Works
  - White Water Canyon Area
  - Nickelodeon Central
  - KidZville

- Canada's Wonderland is contemplating the addition of a tenth area – The Mathemagical Kingdom!

- The Grade 9 and 10 Math students have been made honorary consultants for the "Mathemagical Kingdom" project and they will be required to submit regular reports of their own ideas as outlined by their teachers.

- Students will be assigned a variety of tasks, and asked to use the skills they have learned this semester to write up their reports. Since students will be assessed on their work, all reports will be handed in at the end of class, unless stated otherwise by their teacher.

- During this assessment, students will be assigned to specific groups to collect data and brainstorm ideas and possible strategies. Group time will be limited, however, and students will be required to write up their findings on their own and submit them as required by their teachers.

- Student consultants are expected to write up their reports using appropriate mathematical terminology with full justifications for their recommendations.

The Mathemagical Kingdom

The Mathemagical Kingdom will offer three different admission packages:

Plan A: $10 admission plus $1 per ride
Plan B: $2 per ride
Plan C: $30 for a one day pass that includes an unlimited number of rides

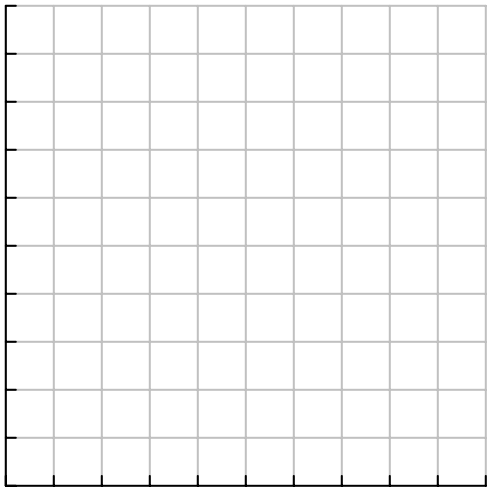
a) Complete the tables of values for each plan.

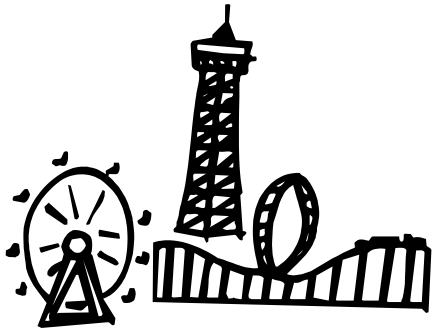
Plan A	
# of rides	Cost ($)
0	
2	
4	
6	
8	
10	
12	
14	
16	
18	
20	

Plan B	
# of rides	Cost ($)
0	
2	
4	
6	
8	
10	
12	
14	
16	
18	
20	

Plan C	
# of rides	Cost ($)
0	
2	
4	
6	
8	
10	
12	
14	
16	
18	
20	

b) Display this data on the grid below.
Use a different colour for each plan. Remember to title the graph and label the axes.





c) Write an equation for the cost of each plan.
Use **n** to represent the number of rides and **C** to represent the cost.
(The equation for Plan B is done for you.)

Plan A	Plan B	Plan C
	$C = 2 \times n$	

d) Calculate the cost of admission for a customer that goes on 7 rides.
Show your work below or on your graph.

Plan A	Plan B	Plan C

Which plan should a customer choose if they intend to go on 5 rides?

e) Complete each of the following sentences.

I would choose Plan A if…	I would choose Plan B if…	I would choose Plan C if…

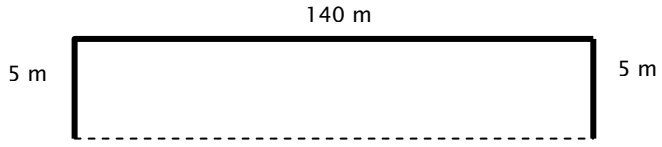
f) An advertisement in a local paper shows another admission plan for the Mathemagical Kingdom.
It advertises $10 for admission plus $1.25 per ride.
A customer rejects this plan without creating a graph or calculating costs.
Explain the customer's reason for rejecting this plan so quickly.
Use the vocabulary of lines (C-intercept, slope) as you make your argument.

The Mathemagical Kingdom

Canada's Wonderland would like you to design a swimming area on the waterfront in the Mathemagical Kingdom. There is 150 m of rope available to enclose the swimming area. The shore will be one side of the swimming area; so only three sides of the rectangle will be roped off. It is your job to design the largest rectangular swimming area that can be enclosed with 150 m of rope.

Explore

It is possible to build a long, narrow swimming area.



Area = length × width
Area = 5 × 140
Area = 700 m^2

Sketch three more swimming areas that have a larger area than this swimming area.
Label the dimensions on the sketch and calculate the area as shown above.

Hypothesize

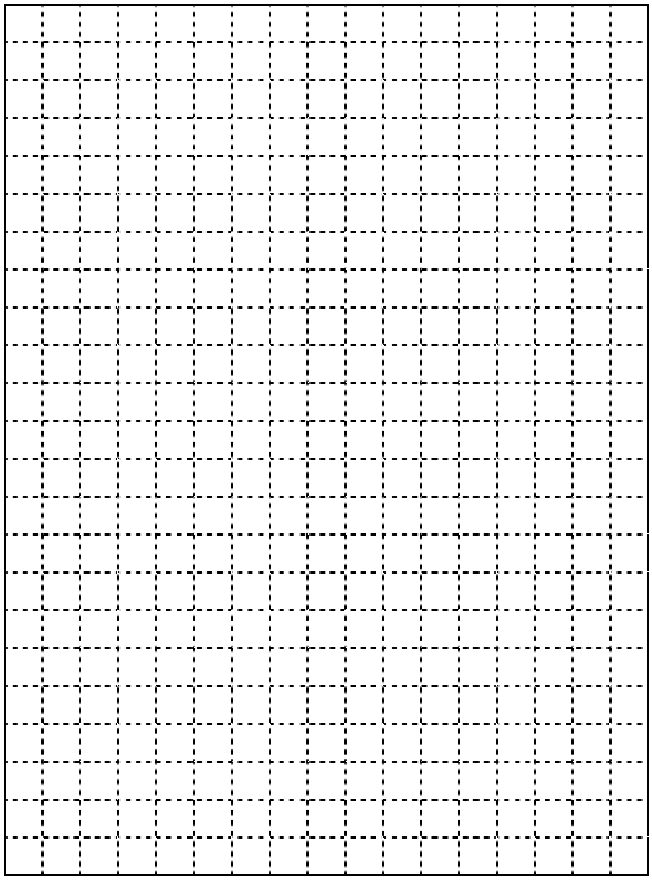
Based on your exploration, predict the dimensions of the largest rectangular swimming area.

Model

Complete the table with possible combinations of width and length for the swimming pools.

Perimeter (m)	Width (m)	Length (m)	Area (m^2)
150	0	150	0
150	5	140	700

Construct a scatter plot of Area versus Width.



Manipulate

Look at the scatter plot.
Circle the region on the scatter plot where the area of the swimming area is the largest.
Construct two more sketches of swimming areas with lengths and areas in this region.

Add these points to the scatter plot.

Conclude

Write a report to the Canada's Wonderland advising them of the dimensions that would be best for the new swimming area. Justify your choice. Include a sketch and the area of the swimming area that you are recommending.

The Mathemagical Kingdom

You have been hired by Canada's Wonderland to draw a scale diagram of a new ride in the Mathemagical Kingdom. Use a scale of 1: 500 to draw a scale plan of your design.

1. The lot size is 80 m by 100 m. Draw a scale plan of the lot.

2. Safety regulations state that a ride cannot cover more than 25% of the total area of the lot.
   a) What is the total area of lot?

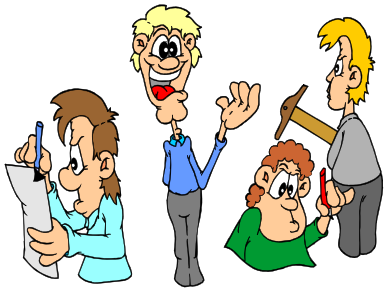
   b) What is the maximum area for the ride?

3. CW has decided that they want the ride to cover this maximum area.
   What dimensions will you suggest for this ride?

4. CW requires that all rides be at least 10 m from the perimeter of the lot.
   Draw this ride to scale on your lot.
   (Keep in mind you will need to add landscaping in the steps that follow.)

5. The path to the ride needs to be 2.5 m wide.
   Indicate where the path will be on your lot.
   (Keep in mind that this path should be able to accommodate long line-ups.)

6. Add landscaping to your plan.



7. What is the ratio of landscaped area to total area for your design?

8. Complete a report for Canada's Wonderland.
   Explain your reasoning for the placement of the ride.
   Explain the location of path and the proposed landscaping.
   Include any calculations necessary to show that all specifications have been met.

The Mathemagical Kingdom

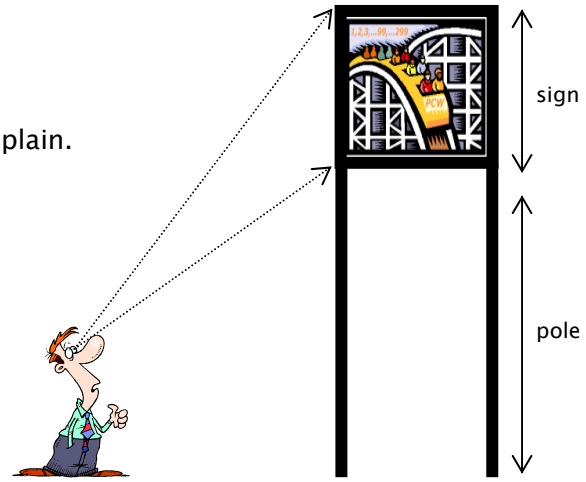
You need to determine the size of the sign that you will post outside the Mathemagical Kingdom. With your pencil and clinometer in hand, you set out to analyze the sign of another area of the Park.
You stand 5 m from the foot of the pole supporting the sign you want to analyze.

a) Using the clinometer, you measure the angle of elevation to the top of the sign to be 55°.
Draw and label a diagram.
Calculate the distance from the ground to the top of the sign.

b) Using the clinometer, you measure the angle of elevation to the bottom of the sign to be 45°.
Draw and label a diagram.
Calculate the distance from the ground to the bottom of the sign.

c) Calculate the height of the sign.

d) What dimensions will you choose for the new sign? Explain.
Draw a diagram of your sign.



The Mathemagical Kingdom

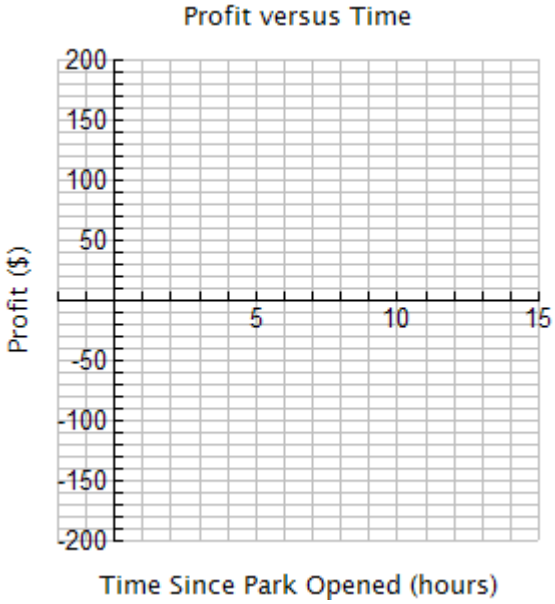
Canada's Wonderland is open from 10:00 am to 10:00 pm.
The day begins by opening up the concessions. Not many customers arrive this early in the day. Typically the number of customers in the Park drops off at the end of the day as well.

After analyzing the profit at one Wonderland concession stand for a long period of time, you have determined that:

$$y = -11.1(x - 5)^2 + 100$$

is the best model to describe the hourly profit in dollars (y) compared to the number of hours the Park has been open for the day (x).

1. Using a graphing calculator, sketch the graph of the profit function for Canada's Wonderland on the grid below.
   Note: At 10:00 am, x = 0.



2. What is the maximum hourly profit?

3. At what time does the maximum hourly profit occur?

4. At what times of the day do you break even?

5. For how many hours are you making money?

6. When is your hourly profit increasing?

7. When is your hourly profit decreasing?
   Your friends will open a new concession stand in the Mathemagical Kingdom.
   They expect their main clientele to come during the 1.5 hours that customers have their lunch.
   They expect their maximum profit to be $80/h.

8. Sketch a possible profit graph for your friend on the grid on page one.
   Explain the assumptions you made as you sketched your friend's profit function.
   (There is no one correct answer to this question.)

10. For your friend's profit function, identify how the values of a, h, and k will be different compared to yours. You do not need to determine their actual values, only how they will be different.