Examples of Tasks from ©2008 Course 1, Unit 1

Getting Started

The tasks below are selected with the intent of presenting key ideas and skills. **Not every answer is complete**, so that teachers can still assign these questions and expect students to finish the tasks. If you are working with your student on homework, please use these solutions with the intention of increasing student understanding and independence. A list of questions to use as you work together, prepared in English and Spanish, is available. Encourage students to refer to their class notes and Math Toolkit entries for assistance.

As you read these selected homework tasks and solutions, you will notice that some very sophisticated communication skills are expected. Students develop these over time. This is the standard for which to strive. See Research on Communication.

The Algebra page or the Scope and Sequence (2nd edition) might help you follow the conceptual development of the ideas you see in these examples.

Main Mathematical Goals for Unit 1

Upon completion of this unit, students should be able to:

- be sensitive to the rich variety of situations in which quantities vary in relation to each other.
- represent relations among variables in several ways—using tables of numerical data, coordinate graphs, symbolic rules, and verbal descriptions—and to interpret data presented in any one of those forms.
- recognize important patterns of change in single variables and related variables.

The intent of this unit is to focus student attention on the variety of types of change inherent in problem situations. This unit will provide students with a broad picture of the patterns of change. Students will explore linear, quadratic, inverse variation, and exponential patterns of change throughout the unit. Since this unit is an overview of patterns of change, *mastery is not expected at this stage.*

What Solutions are Available?

Lesson 1: Investigation 1—Applications Task 1 (p. 14), Applications Task 5 (p. 16), Extensions Task 20 (p. 24)
Investigation 2—Connections Task 10 (p. 19)
Investigation 3—Applications Task 6 (p. 16)

Lesson 2: Investigation 1—Applications Task 1 (p. 36), Connections Task 12 (p. 39), Reflections Task 18 (p. 42)
Investigation 2—Applications Task 8 (p. 38)

Lesson 3: Investigation 1—Applications Task 3 (p. 59), Connections Task 13 (p. 62)
Investigation 2—Applications Task 8 (p. 60), Extensions Task 27 (p. 65)
Investigation 3—Applications Task 10 (p. 61)

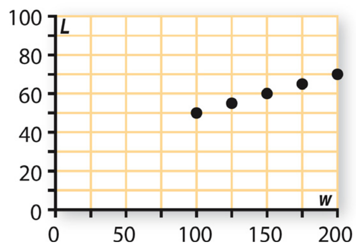
Selected Homework Tasks and Expected Solutions

(These solutions are for tasks in the 2nd edition book—2008 copyright.
For homework tasks in books with earlier copyright dates, see Helping with Homework.)

Lesson 1, Investigation 1, Applications Task 1 (p. 14)

a. *Jumper weight* is the most plausible independent variable and *stretched cord length* the dependent variable because it changes as an effect of changed *jumper weight*.

b.



c. Reasonable estimates are:

i. 47 feet **ii.** 57 feet **iii.** 75 feet

d. In this situation, it probably does make sense to connect the dots to indicate stretched cord length for weight values between the given data points because there is a clear trend and no reason to think the relationship would be any different for weight values between those in the table. Also, values between those in the table make sense (i.e., jumper weight is a continuous variable).

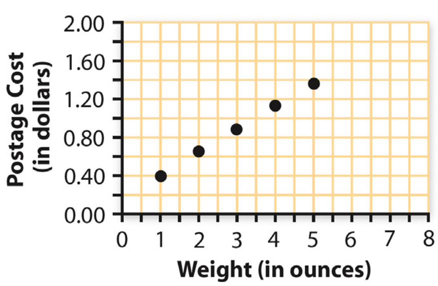
e. Stretched cord length increases steadily as jumper weight increases. For every 25-pound increase in jumper weight, there is a 5-foot increase in stretched cord length or about 0.2 feet per pound of weight.

Note the description of the overall pattern begins with the description in words but also includes the rate at which it is happening using numbers. Together these constitute a complete description.

f. To be completed by the student.

Lesson 1, Investigation 1, Applications Task 5 (p. 16)

a.



b. **i.** 1.5 ounces would cost $0.63.

ii. 4.25 ounces would cost $1.35.

iii. 7 ounces cost $1.83, assuming the pattern of increasing the cost by 24¢ for each ounce continues.

c. To be completed by the student.

Note the difference between the "open" circle ○ and the "closed" (filled in) circle ●. An "open" circle is placed on the graph to show that the number denoted at the circle is *not* included in the solution set, and a "closed" (filled in) circle is placed on the graph to show that the number denoted at the circle is included in the solution set.

Lesson 1, Investigation 1, Extensions Task 20 (p. 24)

a. $I = pn$ or $I = p(50 - p)$
(Recall that Income I is by the price per item p multiplied by the number of items n.)

b. $a = 2^{n-1}$, or $a = 0.5(2^n)$ pennies

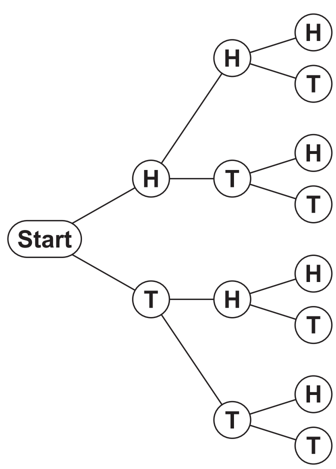
c. $w = \frac{2^{n-1}}{10} = 0.1(2^{n-1})$, or $w = 0.05(2^n)$ pennies

Lesson 1, Investigation 2, Connections Task 10 (p. 19)

a. There are two possible equally likely outcomes, "heads" or "tails," so the probability is $\frac{1}{2}$.

b. There are four possible equally likely outcomes: HH, HT, TH, or TT. So, the probability of getting two heads is $\frac{1}{4}$.

c. A tree diagram will show 8 possibilities, one of which is three heads. Thus, the probability of getting three heads is $\frac{1}{8}$.



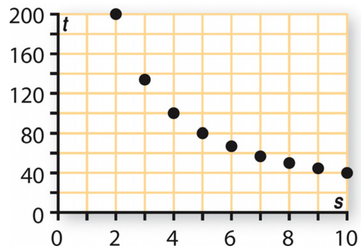
d. To be completed by the student.

e. To be completed by the student.

Lesson 1, Investigation 3, Applications Task 6 (p. 16)

a.

Average Speed (in m/sec)	2	3	4	5	6	7	8	9	10
Race Time (in sec)	200	133	100	80	67	57	50	44	40



b. Race time decreases rapidly as speed increases from 2 meters per second, but for higher speeds a comparable increase in speed does not produce as significant a reduction in time.

c. $t = \frac{400}{s}$

d. The change from 2 m/sec to 4 m/sec produces the greater reduction in race time. That is shown by the fact that the graph drops more rapidly for increases in speed at lower speeds.

Lesson 2, Investigation 1, Applications Task 1 (p. 36)

a.

Year		Population (in billions)
2005		1.3
2006		1.3078
2007		1.3156
2008		1.3235
2009		1.3315
2010		1.3395

b. In about 24 years, at the present growth rate, China's population is projected to reach 1.5 billion.

c. To be completed by the student.

d. **i.** *NEXT* = 1.006 • *NOW*, starting at 1.3.

ii. To be completed by the student.

Lesson 2, Investigation 1, Connections Task 12 (p. 39)

You must use the information in the table above Task 10 to answer this question.

a. If the population continues to increase by 54,000 per decade, its population would be as follows:

Year	2010	2020	2030	2040	2050
Pop. (in 1,000s)	330	384	438	492	546

b. *NEXT* = *NOW* + 54, starting at 276.

c. $\frac{54}{222} = 24.3\%$

d. To be completed by the student.

e. To be completed by the student.

Lesson 2, Investigation 1, Reflections Task 18 (p. 42)

Similarities: In both kinds of relational situations, tables and graphs of values and (where feasible) algebraic rules are useful tools for studying patterns of change. It usually helps to look for increasing or decreasing change patterns as values of the independent variable increase steadily and, more precisely, to ask whether the rate of change is constant or not.
Differences: In "cause-and-effect" change situations, one can generally imagine some sort of operational connection between the variables that explains why the dependent variable changes when the independent variable changes. In "change-over-time" situations, the time variable itself is not a cause of change, only a marker that helps to see the rate of change that results from a variety of situational factors.

Lesson 2, Investigation 2, Applications Task 8 (p. 38)

Spreadsheets will vary, but the basic code will include something like the *NOW-NEXT* rules in each task. Here is a sample spreadsheet that could be used to begin analysis of factors in the population growth of China as described in Task 1.

China Population.xls

◇	A	B (Formulas)	B (Computations)	C	D
1	Year	Population	Population	Start=	1.3
2	2006	=D1*D$2	1.3078	Rate=	1.006
3	=A2+1	=B2*D$2	1.316		
4	=A3+1	=B3*D$2	1.324		
5	=A4+1	=B4*D$2	1.331		
⋮	⋮	⋮	⋮	⋮	⋮
6					

Lesson 3, Investigation 1, Applications Task 3 (p. 59)

$d = 330t$, where t is the time in seconds and d is the distance away in meters of the lightning strike. The rule assumes that the sight of lightning arrives instantly.

Lesson 3, Investigation 1, Connections Task 13 (p. 62)

a.

Radius *r*	0	1	2	3	4	5	10	20
Circumference *C*	0	2π	4π	6π	8π	10π	20π	40π
Area *A*	0	π	4π	9π	16π	25π	100π	400π

b. Circumference grows at a steady rate—as radius increases by 1, circumference increases by 2π; area grows at an increasing rate due to the squaring of the radius.

c. If radius is doubled, the area is multiplied by 4; tripling the radius multiplies the area by 9.

d. If the radius is doubled, the circumference is also doubled. If the radius is tripled the circumference is also tripled.

e. To be completed by the student.

f. To be completed by the student.

Lesson 3, Investigation 2, Applications Task 8 (p. 60)

a. **i.** To be completed by the student.

ii. To be completed by the student.

b. $48 < p < 152$; Ticket prices more than \$48 and less than \$152 will give income of at least \$550,000.

Students are expected to arrive at this answer by using a graph or a table that is produced by either a graphing calculator or *CPMP-Tools*.

c. To be completed by the student.

d. To be completed by the student.

e. Income is 0 when $p = 0$ (free admission) or when $p = 200$.

Students can arrive at this answer by looking at the formula for income, $I = p(15{,}000 - 75p)$, or by using a table or graph produced by a graphing calculator or *CPMP-Tools*.

f. To be completed by the student.

Lesson 3, Investigation 2, Extensions Task 27 (p. 65)

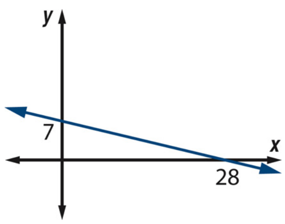
a. If d represents distance of the trip and C represents cost of the trip:
Metro Cab: $C_M = 1.50 + 0.80d$

The rule for the competitor, Tack See Inc., should be completed by the student.

b–d. To be completed by the student.

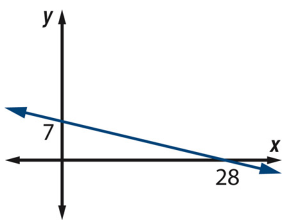
Lesson 3, Investigation 3, Applications Task 10 (p. 61)

a.



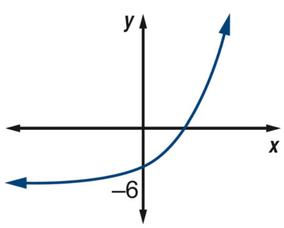
The graph is valley-shaped because the x^2 term is positive. It crosses the y-axis at 4.

b.



The graph is linear and crosses the y-axis at 7 and the x-axis at 28.

c.



The 4^x means that the function is exponential, so it goes up quickly. The y-intercept is –6 since $4^0 - 7 = -6$.

