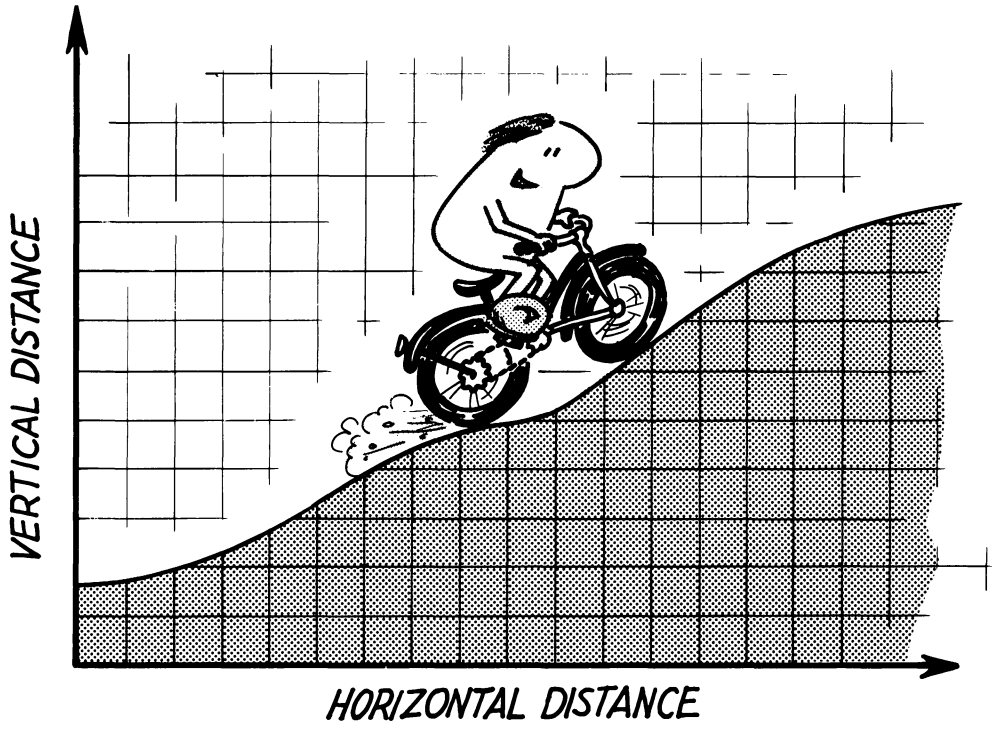
GRAPHING



TASK CARD SERIES

Conceived and
written by
Ron Marson
Illustrated by
Peg Marson

TOPS LEARNING SYSTEMS

10970 S. Mulino Rd.
Canby OR 97013

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Gathering Materials

Listed below is everything you'll need to teach this module. You already have many of these items. The rest are available from your supermarket, drugstore and hardware store. Laboratory supplies may be ordered through a science supply catalog. Hobby stores also carry basic science equipment.

Keep this classification key in mind as you review what's needed:

special in-a-box materials:	general on-the-shelf materials:
Italic type suggests that these materials are unusual. Keep these specialty items in a separate box. After you finish teaching this module, label the box for storage and put it away, ready to use again the next time you teach this module.	Normal type suggests that these materials are common. Keep these basics on shelves or in drawers that are readily accessible to your students. The next TOPS module you teach will likely utilize many of these same materials.
(substituted materials):	*optional materials:
A parentheses following any item suggests a ready substitute. These alternatives may work just as well as the original, perhaps better. Don't be afraid to improvise, to make do with what you have.	An asterisk sets these items apart. They are nice to have, but you can easily live without them. They are probably not worth an extra trip, unless you are gathering other materials as well.

Everything is listed in order of first use. Start gathering at the top of this list and work down. Ask students to bring recycled items from home. The teaching notes may occasionally suggest additional student activity under the heading "Extensions." Materials for these optional experiments are listed neither here nor in the teaching notes. Read the extension itself to find out what new materials, if any, are required.

Needed quantities depend on how many students you have, how you organize them into activity groups, and how you teach. Decide which of these 3 estimates best applies to you, then adjust quantities up or down as necessary:

$Q_1 / Q_2 / Q_3$

- **Single Student:** Enough for 1 student to do all the experiments.
- **Individualized Approach:** Enough for 30 students informally working in 10 lab groups, all self-paced.
- **Traditional Approach:** Enough for 30 students, organized into 10 lab groups, all doing the same lesson.

KEY: *special in-a-box materials* (substituted materials) general on-the-shelf materials *optional materials

$Q_1 / Q_2 / Q_3$	
1 / 10 / 10	textbooks with a least 400 pages
2 / 20 / 20	index cards — 4x6 or larger
1 / 10 / 10	pairs of scissors
1 / 1 / 1	spools of thread
1 / 1 / 1	roll masking tape
1 / 5 / 10	100 ml graduated cylinders
1 / 20 / 30	100 ml beakers
1 / 10 / 10	large test tubes with 20-30 ml capacities
1 / 5 / 10	*drinking glasses that taper outward — clear plastic disposable beverage cups often have this shape; choose the most exaggerated style*
1 / 5 / 10	Erlenmeyer flasks, 100 ml or larger
.3 / 1 / 3	cups oil-based clay
1 / 5 / 10	small test tubes with 5-10 ml capacities
4 / 20 / 40	*cylinders of various sizes and kinds, including cans bottles and lids*
1 / 1 / 1	roll string
1 / 5 / 10	*hand calculators
1 / 5 / 10	soup cans or equivalent size
1 / 10 / 10	thin rubber bands of uniform thickness, about 6 cm long
2 / 20 / 20	paper clips
1 / 10 / 10	pieces lined notebook paper
1 / 20 / 30	metric rulers
1 / 4 / 10	*chrome-plated tubing at least one inch in diameter or larger*

Sequencing Task Cards

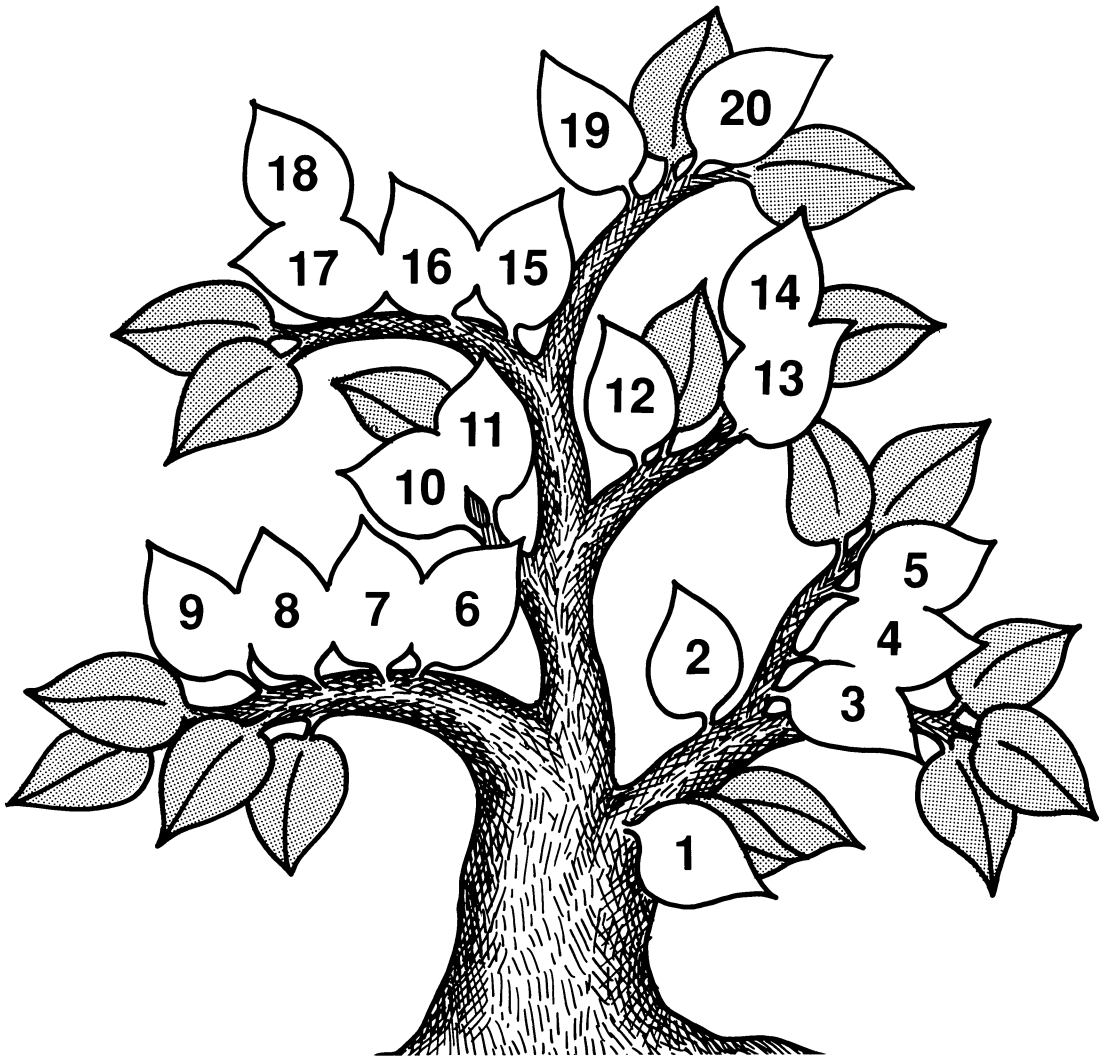
This logic tree shows how all the task cards in this module tie together. In general, students begin at the trunk of the tree and work up through the related branches. As the diagram suggests, the way to upper level activities leads up from lower level activities.

At the teacher's discretion, certain activities can be omitted or sequences changed to meet specific class needs. The only activities that must be completed in sequence are indicated by leaves that open *vertically* into the ones above them. In these cases the lower activity is a prerequisite to the upper.

When possible, students should complete the task cards in the same sequence as numbered. If time is short, however, or certain students need to catch up, you can use the logic tree to identify concept-related *horizontal* activities. Some of these might be omitted since they serve only to reinforce learned concepts rather than introduce new ones.

On the other hand, if students complete all the activities at a certain horizontal concept level, then experience difficulty at the next higher level, you might go back down the logic tree to have students repeat specific key activities for greater reinforcement.

For whatever reason, when you wish to make sequence changes, you'll find this logic tree a valuable reference. Parentheses in the upper right corner of each task card allow you total flexibility. They are left blank so you can pencil in sequence numbers of your own choosing.



Review / Test Questions

Photocopy the questions below. On a separate sheet of blank paper, cut and paste those boxes you want to use as test questions. Include questions of your own design, as well. Crowd all these questions onto a single page for students to answer on separate pieces of graph paper. Duplicate a class set and your custom-made test is ready to use. Use leftover questions as a review in preparation for the final exam.

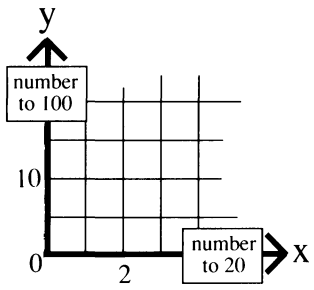
task 1

Draw a pair of coordinates on graph paper. Then draw a straight line from (2,1) to (5,8) to (8,1) to (1,5) to (9,5) to (2,1). What have you drawn?

task 2

Draw these coordinates as scaled. Plot the points in this data table and draw a suitable graph line.

x	y
0	0
2	7
5	20
9	34
12	46
19	69

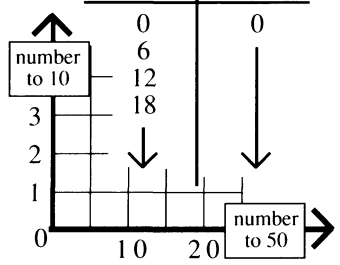


task 3-5

A stack of 6 quarters measures 1 cm high.

a. Fill in this table and graph your results.

number of quarters	height (cm)
0	0
6	
12	
18	



b. Banks sell quarters in 10 dollar rolls. Use your graph to predict the length of each roll.

task 4

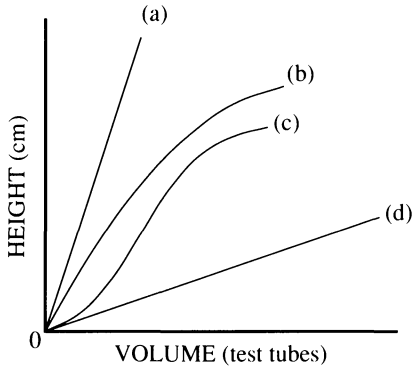
a. Extrapolate the graph (directly above) to find how many quarters form a stack 35 cm high.

b. Prove your extrapolation is correct by solving this proportion:

$$\frac{1 \text{ cm}}{6 \text{ quarters}} = \frac{35 \text{ cm}}{?}$$

task 6-9

This graph shows how the height of water in 4 bottles varies with the volume of water added. Draw each bottle, giving reasons for the shapes you choose.



task 10-11

For each table, decide by graphing if **x** is directly proportional to **y**. Use math to show you are correct.

(a)

x	y
0	0
5	2.5
12	6
13	6.5
18	9

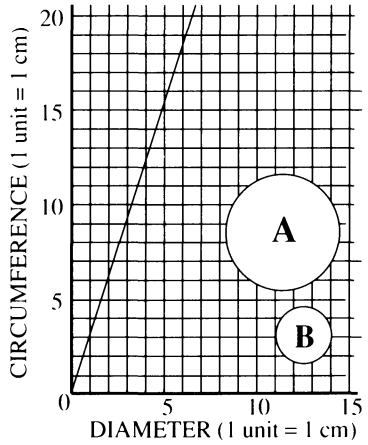
(b)

x	y
0	0
5	1
9	2
12	5
14	9

task 12

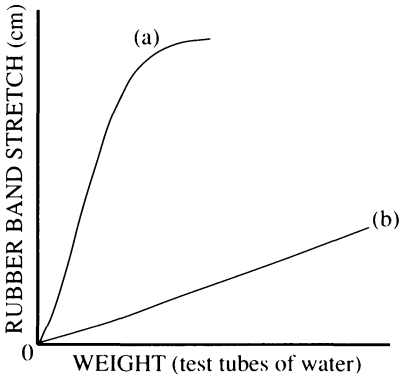
a. Circle A has a circumference of 19 cm. Use the pi graph to find its diameter.

b. Circle B has a diameter of 3 cm. Use the pi graph to find its circumference.



task 13-14

The graph shows how 2 pairs of rubber bands stretch as weight is added.



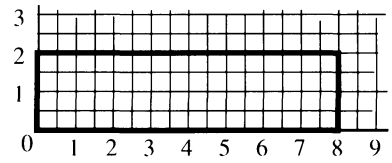
a. Which graph line represents 2 rubber bands connected in parallel (side by side)? Explain.

b. Which graph line represents 2 rubber bands connected in series (end to end)? Explain.

c. Which graph line indicates that the rubber bands may soon break? Explain.

task 15-18

Change the scale on either the x-axis or the y-axis to transform this rectangle into a square.



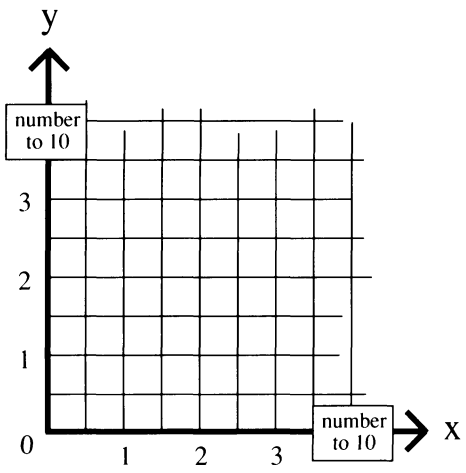
task 19-20

A certain one-celled organism divides every hour. Starting with just 1 organism at time zero, graph the total population of cells over a 12 hour period.

Task Objective (TO) practice plotting ordered pairs of whole numbers on a coordinate system.

ORDERED PAIRS (1) ○ Graphing ( )

1. Draw X and Y coordinates on graph paper. Number alternate lines out to 10 as shown.



2. Plot the ordered pairs listed in each table. Connect points, working down from the top of each table.

(a)

x	y
5	5
5	0
4	2
3	3
3	2
5	0
6	3
7	4
7	3
5	0

(b)

x	y
5	9
4	8
3	8
4	7
3	6
4	6
5	5
6	6
7	6
6	7
7	8
6	8
5	9

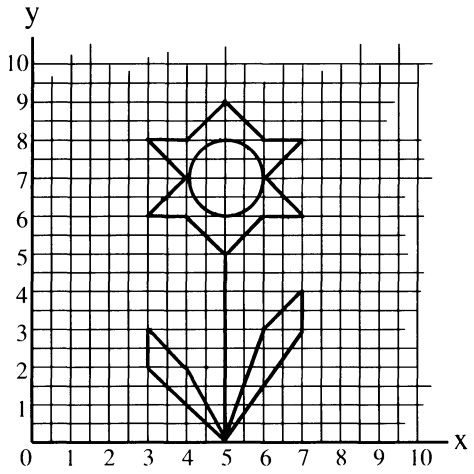
(c)

Make a circle with the center at (5,7) and a radius of 1.

3. What have you drawn?

Answers / Notes

1-3. *The points connect to form a flower.*



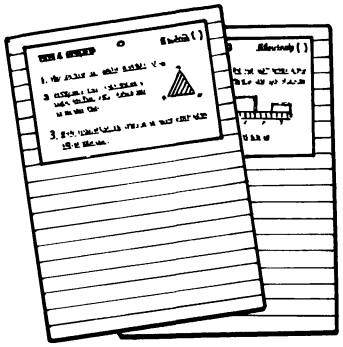
Students should save their graph for later reference. In task cards 15-17 they will transform the shape of their flower by mapping its ordered pairs onto other coordinate systems.

Materials

☐ Graph paper for students to cut apart as needed. Use your own, or photocopy the grid at the back of this book. (Your class will require 10-15 sheets per student, depending on how well they conserve paper and how large they scale their graphs. Run off 10 sheets to start. Photocopy the balance when more exact needs become apparent.)

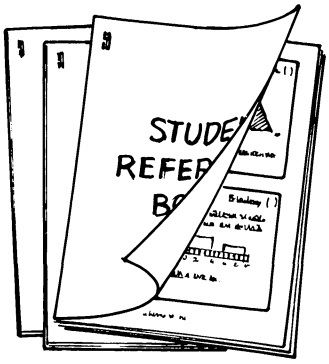
Task Cards Options

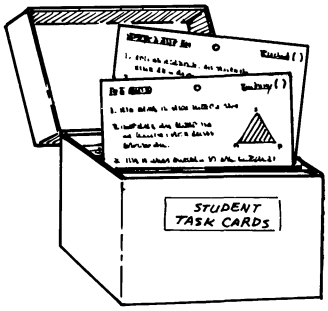
Here are 3 management options to consider before you photocopy:



1. Consumable Worksheets: Copy 1 complete set of task card pages. Cut out each card and fix it to a separate sheet of boldly lined paper. Duplicate a class set of each worksheet master you have made, 1 per student. Direct students to follow the task card instructions at the top of each page, then respond to questions in the lined space underneath.

2. Nonconsumable Reference Booklets: Copy and collate the 2-up task card pages in sequence. Make perhaps half as many sets as the students who will use them. Staple each set in the upper left corner, both front and back to prevent the outside pages from working loose. Tell students that these task card booklets are for reference only. They should use them as they would any textbook, responding to questions on their own papers, returning them unmarked and in good shape at the end of the module.



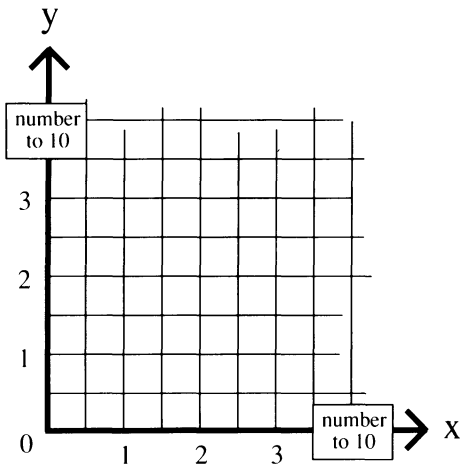


3. Nonconsumable Task Cards: Copy several sets of task card pages. Laminate them, if you wish, for extra durability, then cut out each card to display in your room. You might pin cards to bulletin boards; or punch out the holes and hang them from wall hooks (you can fashion hooks from paper clips and tape these to the wall); or fix cards to cereal boxes with paper fasteners, 4 to a box; or keep cards on designated reference tables. The important thing is to provide enough task card reference points about your classroom to avoid a jam of too many students at any one location. Two or 3 task card sets should accommodate everyone, since different students will use different cards at different times.

ORDERED PAIRS (1)

Graphing ( )

1. Draw X and Y coordinates on graph paper. Number alternate lines out to 10 as shown.



2. Plot the ordered pairs listed in each table. Connect points, working down from the top of each table.

(a)

x	y
5	5
5	0
4	2
3	3
3	2
5	0
6	3
7	4
7	3
5	0

(b)

x	y
5	9
4	8
3	8
4	7
3	6
4	6
5	5
6	6
7	6
6	7
7	8
6	8
5	9

(c)

Make a circle with the center at (5,7) and a radius of 1.

3. What have you drawn?

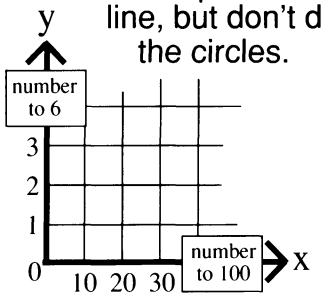
ORDERED PAIRS (2)

Graphing ( )

Draw these 4 coordinate systems (as scaled) on 1 sheet of graph paper. *Plot* and *circle* the ordered pairs in each table. Connect your points with a smooth line, but don't draw inside the circles.

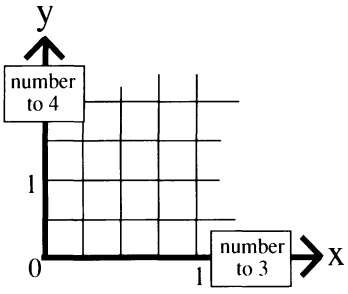
1.

x	y
0	0
20	2.7
40	4.3
60	5.2
80	5.8
100	5.9



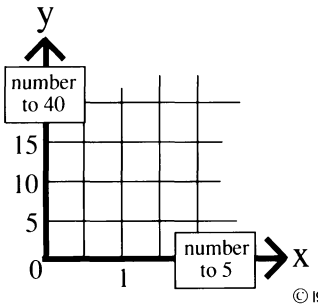
2.

x	y
0	0
.5	.62
1.0	1.25
1.5	1.82
2.0	2.50
2.5	3.17



3.

x	y
0	0
1.0	2
2.0	6
3.0	13
4.0	24
4.5	35



4.

x	y
0	0
.7	.8
2.5	2.2
5.1	3.0
6.6	3.0
8.8	3.6
10.2	4.3