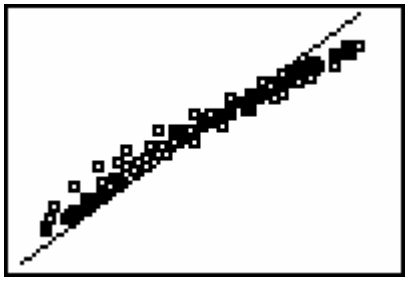
TEACHER INFORMATION

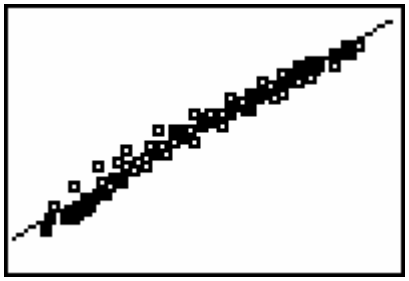
Stretch it to the Limit: The Linear Force Relation for a Rubber Band

1. The four different Motion Detectors that can be used for this activity are; Vernier Motion Detector, CBR, CBR 2, or Go! Motion. Whichever Motion Detector is used, it must be connected to a CBL 2 or LabPro and not directly to the calculator. The CBR, CBR 2, and Go! Motion do not include the required cable to connect to a CBL 2 or LabPro. The Motion Detector Cable (order code: MDC-BTD) can be purchased separately from Vernier Software & Technology.
2. To stretch and relax the rubber band, grasp it with your fingertips or loop it around one finger. The back of your hand should be facing the Motion Detector. During data collection your hand must remain perpendicular to the table surface.
3. The rubber band must remain taut during data collection. If it goes slack the linear relationship between force and distance will not hold.

SAMPLE RESULTS



Raw Data with proportional model



Data with calculator regression

DATA TABLE

x	0.13
y	3.14
K	24

ANSWERS TO QUESTIONS

1. Optimal value for *K* will depend on the rubber band used.
2. The slope obtained by using all the points in the previous step may well be different from the slope obtained by using a single point. The new line passes through one point exactly, and may pass near other points.
3. $y = 0.68 + 18.7\,x$

4. The slope from the linear regression is close to that of the model and single-point *K*. The *y*-intercept should be close to zero since a line of proportionality passes through the origin.

5. The linear regression is a slightly better fit due to the extra parameter. The $y = Kx$ model fits the physical experiment better, however, since at zero stretch the band requires zero force.

6. The force *vs.* stretch graph does not show time. The band was stretched back and forth in time.

7. A stiffer rubber band requires more force to stretch, so its *K* would be larger. The same proportional relationship between force and distance should hold, however.