Find the slopes and y-intercepts of the following lines.

1. $y = 2 - 5x$

2. $y = \dfrac{2x-1}{5}$

3. $x - y = 2$

4. $y = \dfrac{1}{3}(x+2)$

5. $-5y + 2x = 9$

6. $y = \dfrac{12}{48}$

Find the equations of the following lines:

7. Slope is $\frac{1}{2}$; passing through the origin.

8. Slope is $-\frac{1}{3}$; $(2, -3)$ on line.

9. Slope is 0; $(7, 4)$ on line.

10. $(2, -1)$ and $(3, -1)$ on line.

11. $(5, -3)$ and $(-1, 3)$ on line.

12. y-intercept is 2 and $(-2, 3)$ is on line.

Find the equations of the following lines:

13. Parallel to $y = -2x + 1$; $(\frac{1}{2}, 5)$ on line. 14. Parallel to $3x + y = 7$; (-1, -1) on line.

15. Parallel to $5x + 2y = -4$; (0, 17) on line. 16. Parallel to $3x - 6y = 1$; (1,0) on line.

17. Passing through (3,2) perpendicular to 4x - $3y + 2 = 0$

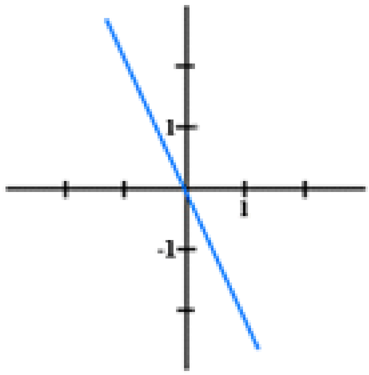
18. Find the equations of the lines through the origin that are parallel and perpendicular to the line $y = 2 - 3x$.

19. Consider the line $y = 2x - 1$. Find the equations of a line parallel to this line passing through the point (2,-1) and a line perpendicular to this line passing through the origin. Sketch a graph of all three lines.

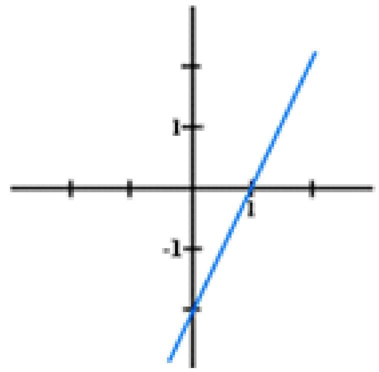
20. Find the equation of the line passing through the points $(-1, 2)$ and $(2, 0)$. What are the slope and y-intercept for this line? Graph the line.

Write the equation of the line for the following graphs:

21.



22.



Word Problems:

23. (8pts) Assuming that water has a density of 1 gm/cm^3 and that the Moon, a sphere, has 3.4 times the density of water with a radius of 1700 km, find the mass of the Moon in kg. The volume of a sphere is given by $V = \frac{4}{3}\pi R^3$. (Note that 1 cm = 10^{-2} m, 1 km = 1000 m, and 1 kg = 10^3 gm.)

24. Find a formula for converting the temperature in Celsius, c, into a temperature in Fahrenheit, f.

25. D. J. Borror and D. M. Long write in their book *An Introduction to the Study of Insects* "The snowy tree cricket, *Oecanthulus fultoni*, a shrub inhabitant, chirps; its chirping is at a very regular rate, which varies with temperature; 40 added to the number of its chirps in 15 seconds gives a good approximation of the temperature in degrees Fahrenheit." Transform this statement into a mathematical model. Sketch the graph.

26. The independent variable is usually the causative variable. Since the rate of chirping of the crickets , N, is determined by the temperature, T, the independent variable should be the temperature. Find the linear cricket equation with N depending on T. This is also known as the inverse equation.

27. Most of the world uses the metric system. Convert the following scenario into one that someone from a metric based country could better understand. Its a beautiful morning with a temperature of 75°F. We travel 5 miles to a beautiful place to take a dive. The water temperature is 65°F with a breeze of 15 miles per hour. We swim 400 yards out to our dive spot where we submerge to a depth of 50 feet. Among the animals that we see are 5 inch abalone, 14 inch lobsters, 2 inch banded gobies, and a 4 foot leopard shark. At the end of the dive we surface 150 yards from shore in 15 feet of water. My tank gauge registers 700 psi (pounds per square inch) of air remaining. (Note that metric countries often use SCUBA gauges in kg/square cm.)

28.Convert this statement from someone in Canada into English units for someone in the United States. Its a beautiful day to go cross-country skiing as the temperature is -8°C, so I packed a 4 kg pack, including 2 liters of water. I travelled 70 kilometers North to the Laurentians where the elevation is about 400 meters. The temperature in the mountains was perfect green wax conditions with -14°C and a breeze of 25 km/hour. The trail traversed 17 km of maple forests with 40 cm diameter trees over an expanse of 30 km^2.

29. The lecture notes gave the average heights of five and seven year olds as 108 cm and 121 cm, respectively. Use these data to estimate the average height of a six year old.

What is the average rate of growth for children these ages in cm/yr?

30. The lecture notes showed the average height of a child satisfies the equation:

$$h = 6.46a + 72.3,$$

where h is the height and a in the age of the child. Find the average height of a six year old using this equation. Is this estimate better or worse than the estimate in Problem 29 and why?

31. Use the equation in Problem 30 for height of a child. If your daughter is 135 cm at age nine, then what does the model predict her height to be at age ten? If she is 160 cm at age 13, then what does the model predict her height to be at age 15? Which of these estimates is better and why?

32. The table below shows growth of a puppy. Find and graph the equation of the line for M as a function of a. Show the data points on the graph. What is the slope of the line and interpret the M-intercept?

Age (a)	Mass (M)
1 week	1.5 kg
2 week	2.1 kg
4 week	3.3 kg
8 week	5.7 kg

33. For a range of values, the absorbance A read from a spectrophotometer varies linearly with the concentration of nickel (II), N. (The measurement is made for the red-colored nickel dimethylglyoximate at 366 nm.) If the spectrophotometer is not carefully calibrated to zero for the reference signal, then one needs to use the formula

$$A = kN + b,$$

for some constants k and b.

a. Suppose that a sample with 0.02 mg/ml of nickel (II) gives an absorbance of 0.26 and one with 0.04 mg/ml of nickel (II) gives an absorbance of 0.44. Find the values for k and b.

b. Find the absorbance for a sample with 0.035 mg/ml of nickel (II).

c. Find how much nickel (II) is in a sample that gives an absorbance of 0.31.

34. For a gas kept at a constant volume, the pressure P depends linearly on temperature T. Thus, we can write the equation

$$P = kT + b,$$

for some constants k and b.

a. Suppose we run an experiment and find that when $T = 0°$C, the pressure $P = 760$ mm of Hg. Then when $T = 100°$C, the pressure $P = 1040$ mm of Hg. Find the constants k and b for the equation above.

b. Absolute zero can be approximated finding where the pressure $P = 0$. Find the temperature in °C for absolute zero from the data points (and the equation above).

35. The level of CO_2 in parts per million (ppm) at Mauna Loa Observatory was found to be 325.3 in 1970 and 338.5 in 1980. Assume the level of CO_2 is linear for some range of dates.

a. Find the equation of the line giving the concentration of CO_2 as a function of the date. Put this equation in slope-intercept form. (Use the date for the independent variable.)

b. Use this equation to estimate the level of CO_2 in 2000 and 1950. Does the model make sense for predicting the level of CO_2 at the time of the Plymouth colony in 1620?

36. In one of the early labs we saw that the improvement in running events has been almost linear over the last century. John Paul Jones (USA) held the world record for the mile in 1913 with a time of 4:14.4 (254.4 sec). More recently, Sebastian Coe (Great Britain) set the world record in 1979 with a time of 3:49.0 (229.0 sec).

a. Find the equation of the line giving the world record time (in sec) as a function of the date. Put this equation is slope-intercept form.

b. Use this equation to estimate when the 4 minute mile occurred. (It was actually broken by Roger Bannister in 1954 with a time of 3:59.4).

c. Use your line to predict the world record time of the mile in the year 2000. Give your time in minutes and seconds.