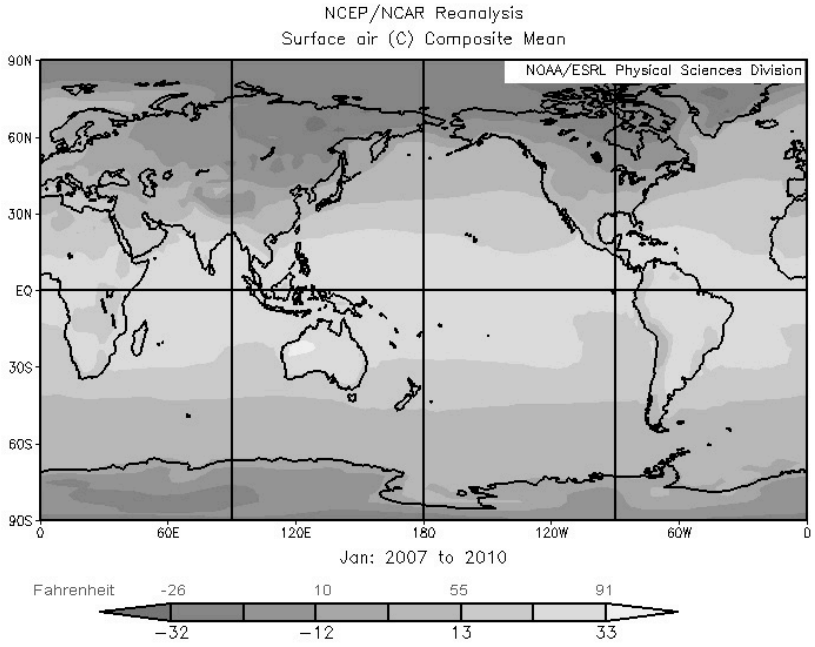
It sure is cold outside, or is it?

I created this map at the National Oceanic and Atmospheric Administration (NOAA) website that shows the relationship between the temperature of places and their latitudes. I guess I always knew that locations near the Equator were warmer than where I live but I started to wonder if you could predict the average temperature of a place if you knew its latitude.



http://www.esrl.noaa.gov/psd/cgi-bin/data/composites/printpage.pl

Part A: I used Google Earth to find the latitude and elevation of a range of places on the earth. Then I used the Weather Underground Trip planner to find the average historical highs and lows of each place in January. (At Weather underground I asked the range of my temperatures to be from January 1 through January 31.)

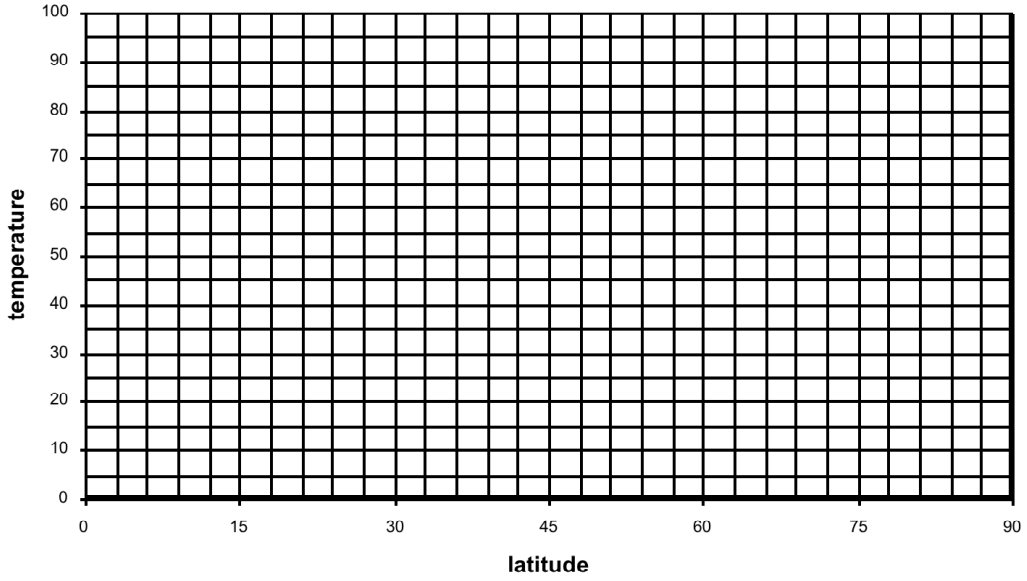
Below is my data. Sometimes I added a note to the data when I thought other factors might have affected the temperatures of that place. I've arranged my chart in ascending order of latitudes and created a column called "average January temperatures" to be the mean of the low and high temperatures.

place	latitude	average January low temps in Fahrenheit	average January high temps in Fahrenheit	average of low and high temperatures	elevation in feet	notes
Quito, Ecuador	0.2309	49	66		9559	high elevation
Kampala, Uganda	.315	67	79		3880	
Camino Real, Guatemala	14.61	33	56		3594	pretty high
Hanoi, Vietnam	21.033	58	69		59	
Houston, Texas	29.762	45	63		155	
Tel Aviv, Israel	32.059		64	56.5	78	
Kabul, Afghanistan	34.4625		42	32.5	7422	high elevation
Tokyo, Japan	43.06	37		43	409	
Oslo, Norway	59.91	22	30		294	
Narsarsuaq, Greenland	61.155		26	21.5	247	
Longyearbyen, Svalbard	78.232	10	19		434	
North Pole	90	no data	no data			

1. I have entered only some of the average highs, lows, and total averages temperatures in January. Please finish my chart by calculating the missing data.

2. To see if there is a correlation, plot the latitude of each of my places along with its **average** January temperature on the grid that is on the next page.

Latitude and Temperature



3. Does it look like latitude and average temperature have a linear relationship?

4. Draw a line that you think might be a line of best fit.

5. What places and latitudes seem to be outliers? Do you have any theories about why they don't seem to fit on your line?

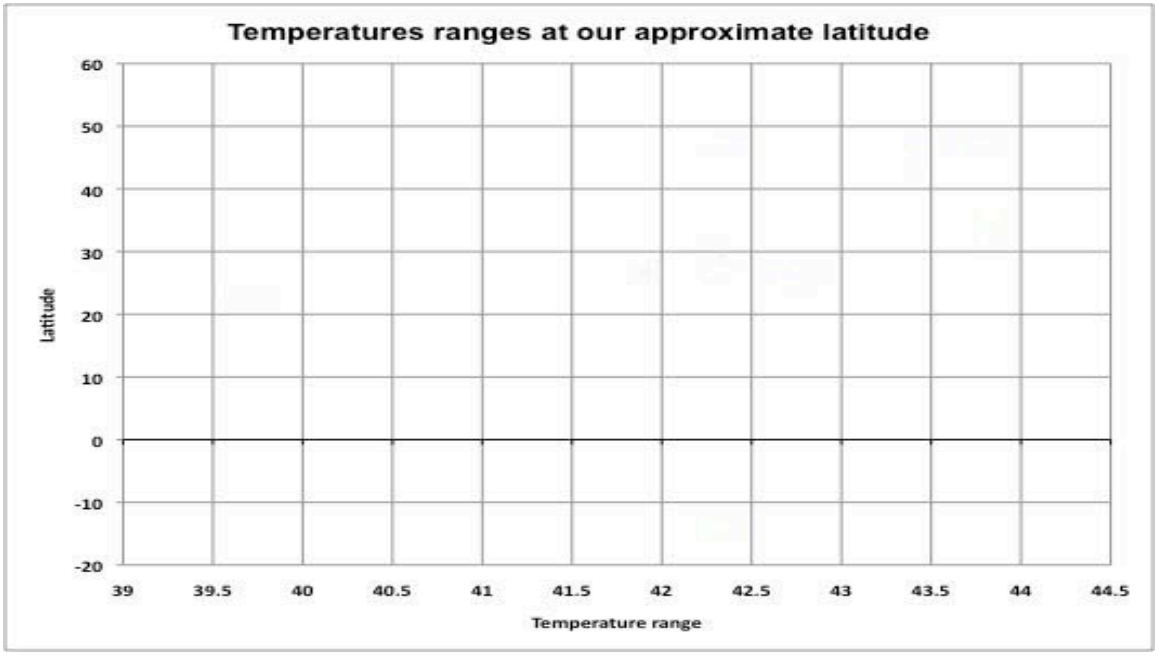
Part B: Places that have latitude that are similar to where I live. I live near Newton, Massachusetts.

	latitude	elevation in feet	January lows	January highs	average of low and high	notes
Beijing, China	39.96	53	15	32		
Chicago, Illinois	41.878	598	21	33		
Newton, Massachusetts	42.337	185	22	35	28.5	
Khangai Nuruu National Park, Mongolia	42.37	4670	-26	-2		
Gold Beach, Oregon	42.407	46	42	54		near ocean
Casper, Wyoming	42.819	5197	16	35		
Grand Rapids, Michigan	42.963	638	20	31		
Lugo, Spain	43.012	1543	44	55		inland
Monte Carlo, Monaco	43.748	179	42	54		near Mediterranean Sea
Sarajevo, Bosnia	43.84	2489	25	38		

6. Plot my data on the following chart. For each place and latitude make a bar that shows the range from low to high with a center mark for the mean temperature.

7. Can you come to any conclusions about where you live and how cold it is?

8. Should I be grateful that it is not as cold as it could be?



Part C: Linear Model Section

Refer back to part A to complete the following problems. You should complete this section if you have or are currently studying linear equations.

9. Determine the slope of the line of best fit. What does the slope represent in this situation?

10. Determine the y–intercept of the line of best fit. What does the y–intercept represent in this situation?

11. I wasn't able to get temperature data for the North Pole. Can you make an approximate guess at that temperature from your graph or by using your equation?

12. The average January temperature in Montreal, Canada is 16 degrees. According to your linear model, at about what latitude should Montreal be at?

13. The latitude of Atlanta, Georgia is about 33 degrees north of the Equator. According to your linear model, what is Atlanta's average January temperature?

14. Go online and check your solutions to problems 13 and 14. How close are your solutions to the actual data? Why might your solutions be different from the actual data?

Extra: Do some research and find out what other variables than latitude can determine the climate of an area. List those variables below. Do any of these variables influence the climate where you live?

More sources:

http://www.ncdc.noaa.gov/cmb-faq/anomalies.php
http://www.classzone.com/books/earth_science/terc/content/investigations/es2101/es2101page02.cfm