z	Area (percent)
0.0	0.0
0.5	38
1.0	68
1.2	76
1.5	86
2.0	95

STAT220: WINTER 2007: QUIZ 2: FEB 15

Student name

____

Section

____

Please fill in your name and section.
Answer the questions, on the question paper.
It should take at most 20 minutes to complete this quiz.

The small table at the top right of the page gives you all the normal distribution area numbers you need to answer the questions in this quiz.

Show your work. In a hypothetical study, researchers wish to study the effect of altitude on aerobic capacity. They recruit a large number of UW students. To be eligible the student must be aged 20-35, must pass a basic health exam, but must not be an athlete exercising regularly at high altitude.
In this question, "students" means students who are eligible for this study.

Exercise bikes are equipped to measure a student's aerobic capacity. What is measured is the maximum sustainable energy output per minute, abbreviated as MSEO. Each student does the test both in Seattle (sea level) and at the top of the Stevens Pass Ski Area chair lift ($6000'$).

The units of MSEO are standardized so that, in Seattle, the average is **100**, and the SD is **18**.
Then, in the same units, at $6000'$, the average is **70** and the SD is **25**.
The correlation coefficient is $r = \mathbf{0.8}$.

Both MSEO variables have normal-shaped histograms, and the scatterplot of MSEO at $6000'$ (y-axis) against MSEO in Seattle (x-axis) is football-shaped.
The r.m.s.error for the regression of y on x is $\sqrt{1-r^2} \times SD(y)$.

1.5 pnts (a) In Seattle, what percentage of students overall have MSEO at or above 127?

z-score $= (127 - 100)/18 \ = 1.5$. **Middle area is 86%**
So 7% are above 127 in Seattle

1.5 pnts (b) At $6000'$, what percentage of students overall have MSEO at or above 100 (the average Seattle level) ?

z-score $= (100 - 70)/25 \ = 1.2$. **Middle area is 76%**
So 12% are above 100 at $6000'$

2 pnts (c) For students who had an MSEO of 127 in Seattle, what is the average MSEO at $6000'$?

z-score for x is 1.5 (from (a)); predicted z-score for y is $0.8 \times 1.5 \ = \ 1.2$
So average for these students is $70 + 1.2 * 25 \ = \ 100$

1.5 pnts (d) For students who had an MSEO of 127 in Seattle, what is the SD of MSEO at $6000'$?

rms.error $= \sqrt{(1 - 0.8^2)} \times 25 \ = \ 0.6 \times 25 \ = \ 15$
This is the required "vertical strip" SD

1.5 pnts (e) For students who had MSEO of 127 in Seattle, what percentage have MSEO at $6000'$ at or above 100 (the overall Seattle average level)?

From (c) their average is 100, so 50% have MSEO at or above 100
(z-score= middle-area = 0.0)

2 pnts (f) For students who had MSEO of 127 in Seattle, what percentage have MSEO at $6000'$ at or above 70 (the overall $6000'$ average level)?

Now value is 70, average is 100, SD is rms error or 15.
So z-score $= (70 - 100)/15 \ = \ -2$**, so between-area is 95%**
So 97.5% of these students have value above 70 at $6000'$.