

1. a. From EXCEL's trendline, the best straight line for the Men's 800m winning times at the Olympics is given by:

$$T = -0.1726Y + 119.11.$$

The best straight line for the Women's 800m winning times at the Olympics is given by:

$$T = -0.256Y + 140.14.$$

b. The model predicts that the best time is 1:50.0 sec for Men in 1948.8, so the closest Olympic year to that date is 1948. This best time was actually bested over a decade earlier in 1932. The model predicts that the best time is 1:55.0 sec for Women in 1994.2, so the closest Olympic year to that date is 1996. This best time was actually bested two decades earlier in 1976, but has not been passed recently.

c. The model predicts the times for the 2004 Olympics for Men and Women to be 100.47 sec (1:40.47) and 112.49 sec (1:52.49), respectively. (The model is clearly predicting times that are too fast.) The percent error for the winning Men's time is -3.81% , while the percent error for the winning Women's time is -3.34%

d. According to the model, Women will outrun the Men just after the 2148 Olympics, and the winning time will be around 75.59 sec. This time is clearly too fast. Women are unlikely to outrun men (when considering winning Olympic times) based on physiology of each gender. The primary problem is that this is simply a linear model, which even in the answers above shows it can't give very reliable results, and will be particularly poor as a predictor extended far past the data. A better model would have a horizontal asymptote that gives the limiting ability of the human species to run 800m.

2. a. The best allometric model for the pulse P as a function of the weight w is given by:

$$P = 193.35w^{-0.2329}.$$

b. Below is a table with the model predictions of the pulse and the percent error for each animal:

Animal	Weight (kg)	Pulse	Model Pulse	% Error
Mouse	0.017	450	499.4	11.0
Hamster	0.103	347	328.3	-5.4
Guinea Pig	0.437	269	234.5	-12.8
Goat	33	81	85.6	5.7
Man	68	65	72.4	11.3
Cattle	500	49	45.5	-7.2

From the error analysis, we see that there is fairly uniform percent error, so any of the animals is equally likely to have the highest error from the model. The guinea pig shows the highest percent error, which is probably due to excitability. It is experimental error. The animal with the lowest percent error is the hamster, but it differs little from the goat. This is random experimental error.

c. With the model, we fill in the table below.

Animal	Weight (kg)	Pulse
Rat	0.076	352
Opossum	1.054	187
Swine	100	66
Elephant	2500	31

The worst error is likely the elephant, as it lies outside the given data. The next largest error is likely to be either the opossum, as it is a marsupial, or the rat, as it is a small animal that is less likely to be at a resting pulse when measured. The best prediction is probably the swine (pig).