Épreuve de section européenne

Heptathlon

The 2008 Olympic Games, in Beijing, gave rise to a renewed interest in many events where the UK stands a good chance of winning medals. One of these events was the heptathlon, which is an athletic contest for women, made up of separate events over two days, in the order shown below.

100m hurdles High jump Shot put 200m	Day 1	Long jump Javelin throw 800m	Day 2

Scoring is based on adding the points scored for each event. A formula is used that gives a score of 1000 for a very good performance. For track events, the points are given by the formula: $P = a(b - M)^c$, where a, b, c are constants, given in the table below, and M is the actual time (in seconds) taken by the competitor.

Track event	a	b	c
100m hurdles	9.23076	26.70	1.835
200m	?	?	?
880m	0.11193	254.00	1.88

There is another scoring formula for field events: $P = a(M - b)^c$, when M is the distance thrown or jumped and the coefficients a, b and c are given in a similar table. Here are the results for the first 3 athletes in Osaka World Championships in Athletics, which were the last world outdoor events before Beijing's Olympic Games:

Name	**100m hurdles** (s)	**High jump** (m)	**Shot put** (m)	**200m** (s)	**Long jump** (m)	**Javelin** (m)	**800m**	**Total points**
Caroline Klüft (SWE)	13.15	1.95	14.81	23.38	6.85	47.98	132.56	7032
Lydmila Blonska (UKR)	13.25	1.92	14.44	24.09	6.88	47.77	136.68	6832
Kelly Sotherton (SWE)	13.21	1.86	14.14	23.40	6.68	31.90	131.58	6510

We can see that it is the best *overall* performance that wins the competition. In fact, the Gold medal winner, Caroline Klüft, won only one single event, the high jump [all the contestants are not listed in the table].

From CIMT, University of Plymouth website

Questions

1. What does the word "heptathlon" mean?
2. Calculate the points P scored by Kelly Sotherton in the 100m hurdles. (Note that "points scored" are always the actual value, rounded down.)
3. Now we are going to look at one formula in particular, namely the points formula for the 800m, which is $P = 0.11193 \times (254 - M)^{1.88}$.
   (a) What points would you score if $M = 0$?
   (b) What is the time M, in seconds, that gives $P = 0$?
   (c) What is the time M, in seconds, that gives $P = 1000$?
4. Explain how you could compute the missing coefficients a, b, c for the 200 m, knowing that:
   - if $M = 42.50$ then $P = 0$ (very poor performance) ;
   - if $M = 23.80$ then $P = 1000$ (good performance) ;
   - if $M = 21.82$ then $P = 1200$ (excellent performance).