

Part 1:

Let: t = time held
 T = total time allowed
 d = distance traveled

Then:

$$d = t(T - t)$$

$$d = -t^2 + tT$$

$$-d = t^2 - tT$$

$$\left(\frac{T}{2}\right)^2 - d = t^2 - Tt + \frac{T^2}{4}$$

$$\sqrt{\left(\frac{T}{2}\right)^2 - d} = \left(t - \frac{T}{2}\right)$$

$$\sqrt{\left(\frac{T}{2}\right)^2 - d} = t - \frac{T}{2}$$

$$t = \frac{T}{2} + \sqrt{\left(\frac{T}{2}\right)^2 - d}$$

Note that with $t \in \mathbb{Z}$, the number of ways to get the required score is $\lceil t^+ \rceil - \lceil t^- \rceil + 1 = \lceil t^+ \rceil - \lfloor t^- \rfloor$

Example:

T	d	t^+	t^-	ways
7	9	5.30	1.70	4
53	275	47.17	5.83	42
71	1181	44.40	26.60	18
78	1215	56.49	21.51	35
80	1524	48.72	31.28	17

Product: 449820

Part 2:

T	d	t^+	t^-	ways
53717680	275118112151524			
t^+		t^-		

47484387.82 5733492.18

Ways: 42250895