## Answer Teaser 3121 - Nicky Davis

For n questions the possible non-positive total marks for the test are 0, -1, -2, -3, ..... -n, a total of n+1 possible test results.

The positive test results, with m as the marks given for a correct answer, can be written in columns:

nm (n-1)m (n-2)m	(n-1)m-1 (n-2)m-1	(n-2)m-2			
	•	•			
m	m-1	m-2			m-(n-1)

The first column has from 1 to n correct answers, with any other questions not attempted.

The second column has from 1 to n-1 correct answers, 1 incorrect answer, with any other questions not attempted. The third column has from 1 to n-2 correct answers, 2 incorrect answers, with any other questions not attempted. Etc.

The number T of possible test results if m=1 is the n possible test results from the first column plus the n+1 non-positive results: T=2n+1 For m=1 all other columns duplicate other results.

For m=2 the n-1 possible test results from the second column need to be added then all other columns duplicate other results. For m=3 the n-2 possible test results from the third column also need to be added then all other columns duplicate other results. Etc.

Tabulating values of T for different n and number of columns included gives Tm:

n	<u>T1=2n+1</u>	T2=T1+n-1	<u>T3=T2+n-2</u>	<u>T4=T3+n-3</u>	<u>T5=T4+n-4</u>	<u>T6=T5+n-5</u>	<u>T7=T6+n-6</u>	<u>T8=T7+n-7</u>	<u>T9=T8+n-8</u>	<u>T10=T9+n-9</u>	T11=T10+n-10
13	27	39	50	60	69	()	84	90	95	99	102
14	29	42	54	65	75	84	92	99	105		
15	31	45	58	70	81	91	100				
16	33	48	62	75	87	98	108				
17	35	51	66	80	93	105					
18	37	54	70	85	99	112					
19	39	57	74	90	105						
20	41	60	78	95	111						
21	43	63	82	100							
22	45	66	86	105							
23	47	69	90	110							
24	49	72	94	115							
25	51	75	98	120							
26	53	78	102	120							
27	55	Q1	106								
20	55	01	110								
20	57	04	110								
29	59	87	114								
30	61	90	118								
31	63	93	122								
32	65	96	126								
33	67	99	130								
34	69	102									

For lower n, T=100 is not reached. For higher n, T=2n+1 which is odd so cannot be 100.

The only two cases that give T=100 are n=15, m=7, for which highest mark nm=105 and n=21, m=4, for which highest mark nm=84.

## Answer = 105