ESCAPE FROM ALCATRAZ

THE SCENARIO

A prisoner sits in his cell planning his escape. The prisoner is kept in by 5 laser beams, which operate along a corridor.

The laser beams are switched off at specific time intervals and long enough to allow a person to walk through one laser beam.

The different number of minutes that each laser beam is switched off is shown below:

Laser One	Laser Two	Laser Three	Laser Four	Laser Five
3 min	2 min	5 min	4 min	1 min

THE SCENARIO (cont.)

The guard patrols and checks the prisoner whenever all the laser beams are off simultaneously.

The prisoner knows it will take him 30 seconds to travel between Laser One and Two, between Laser Two and Three, between Laser Three and Four, between Laser Four and Five.

Laser One is situated at the entrance of the prisoner's cell.

He also knows that if he spends longer than 4 minutes 12 seconds in the corridor an alarm will go off.

Task 1 - DRAW IT OUT

A prisoner sits in his cell planning his escape. The prisoner is kept in by 5 laser beams, which operate along a corridor.

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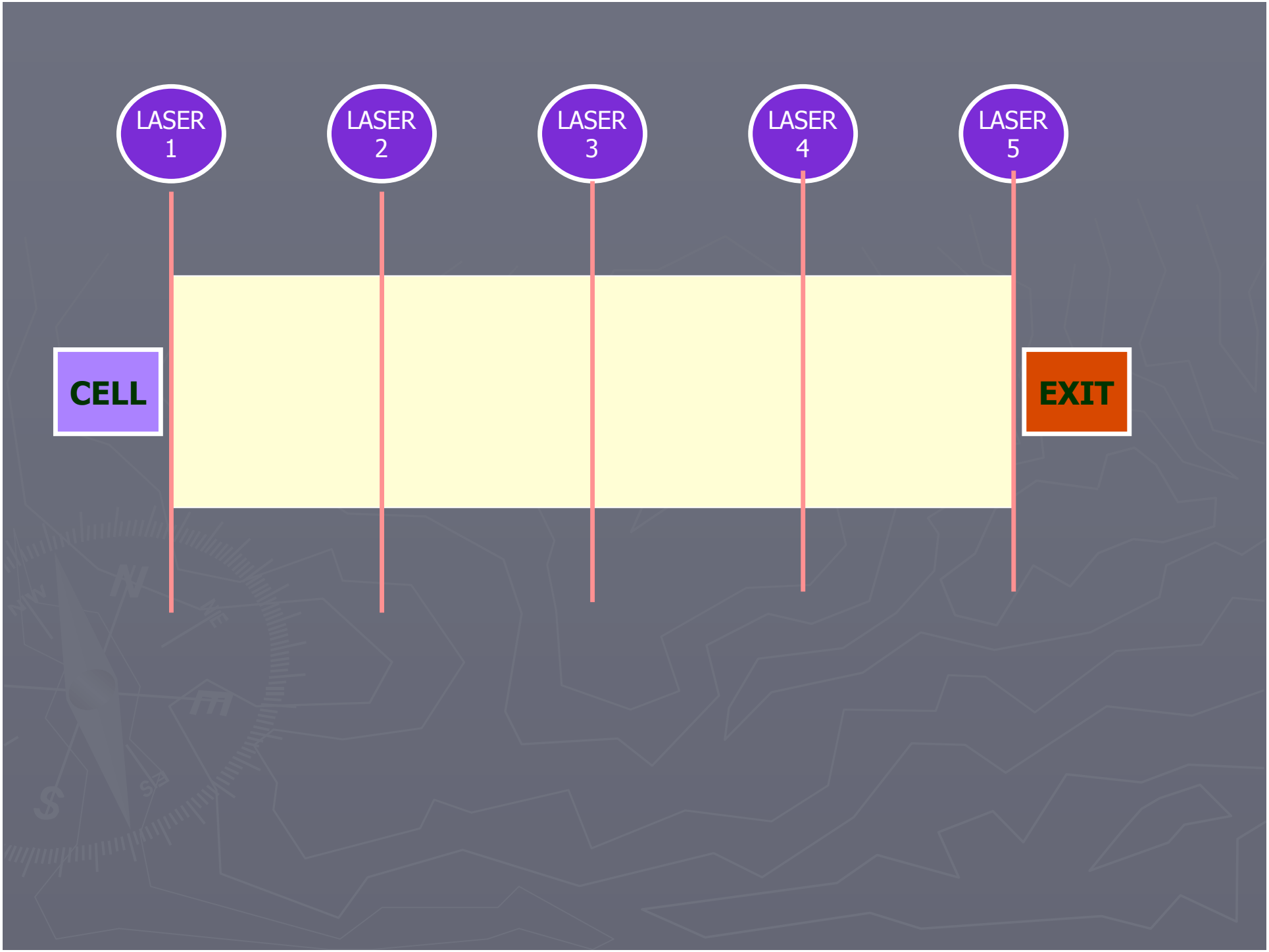
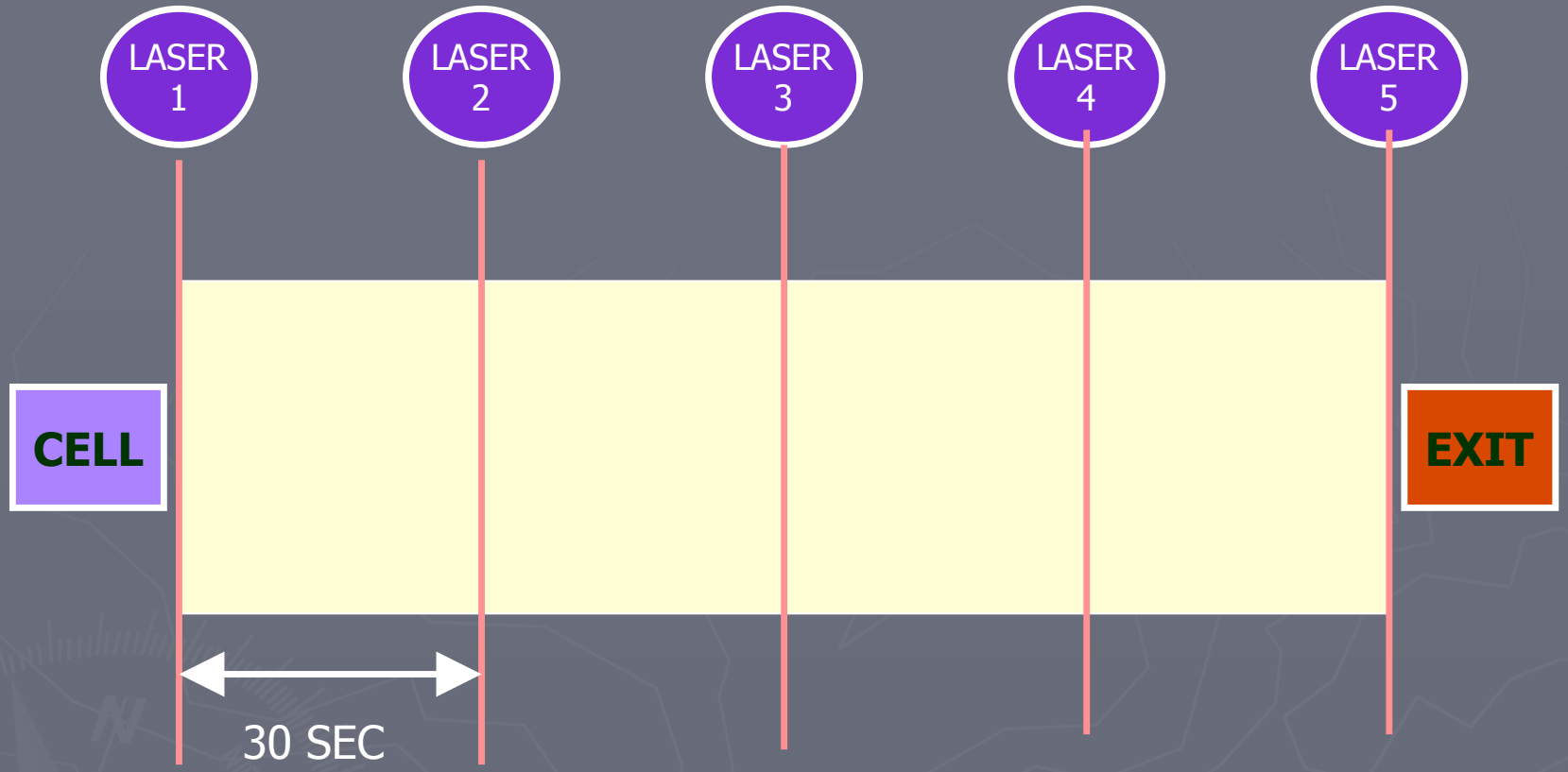
Task 1 - DRAW IT OUT

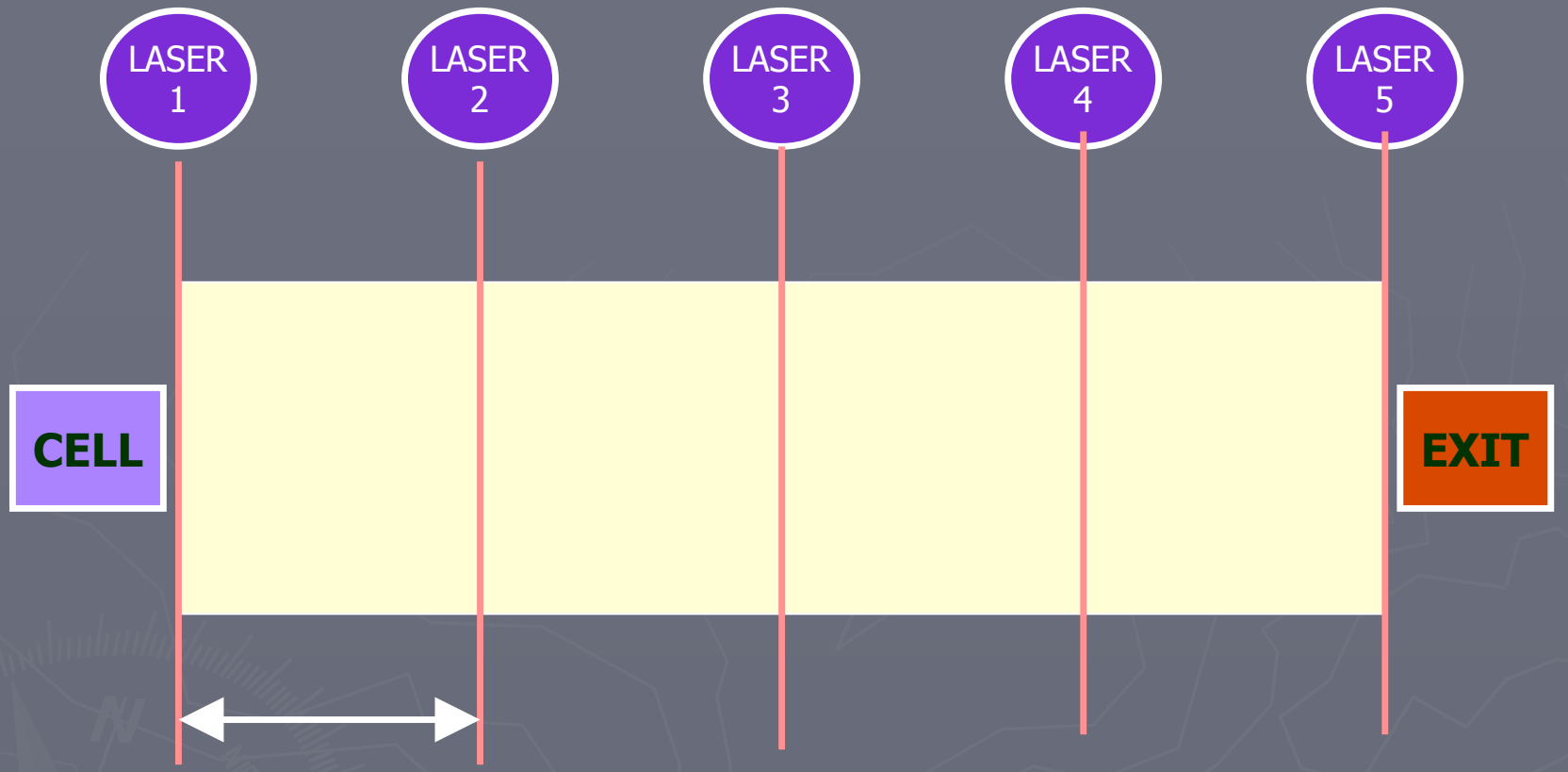
Draw out the positions of the 5 lasers


LASER 1
LASER 2
LASER 3
LASER 4
LASER 5
CELL
EXIT



What is the minimum time that he will need to walk across the corridor?

What is the maximum time that he can spend on the corridor?



CORRIDOR
(4 MIN 12 SEC)

TOTAL TIME THAT HE NEEDS TO WALK NON-STOP ACROSS THE CORRIDOR (2 MIN)

WHEN WILL HE APPEAR AGAIN?

Remember that the guard patrols and checks the prisoner whenever all the laser beams are off simultaneously.

Q1. If the guard checked on the prisoner at 1.30 am, when will he return again?

LOWEST COMMON MULTIPLES

The lowest common multiple of 1, 2, 3, 4 and 5 is 60.

Hence, the guard will return every 60 min.

The guard will return at 2.30 am.

Task 2 – LIST IT OUT

Let the time when the guard leaves be 0 units' time …

Timing of the Lasers

Laser One	Laser Two	Laser Three	Laser Four	Laser Five
0, …	0, …	0, …	0, …	0, …

Timing of the Lasers

Laser One		Laser Two		Laser Three	Laser Four	Laser Five			
0		0		0	0	0			
3	48	2	32	5	4	1	16	31	46
6	51	4	34	10	8	2	17	32	47
9	54	6	36	15	12	3	18	33	48
12	57	8	38	20	16	4	19	34	49
15	60	10	40	25	20	5	20	35	50
18		12	42	30	24	6	21	36	51
21		14	44	35	28	7	22	37	52
24		16	46	40	32	8	23	38	53
27		18	48	45	36	9	24	39	54
30		20	50	50	40	10	25	40	55
33		22	52	55	44	11	26	41	56
36		24	54	60	48	12	27	42	57
39		26	56		52	13	28	43	58
42		28	58		56	14	29	44	59
45		30	60		60	15	30	45	60

Q2. How long does the prisoner have to wait after the guard leaves before entering the corridor to escape from his cell? (Answer your questions in terms of minutes after the 0 units' time)

Q3. When will he clear the final door before the guard returns? (Answer your questions in terms of minutes after the 0 units' time)

Q4. How long does he spend along the corridor?

Q5. If the prisoner can escape, how much time has he got before the guard raises the alarm?

SOME HINTS

- Consider the length of time that the prisoner can stay in the corridor without triggering the alarm
- Consider the time that the prisoner needs to travel across the corridor
- Consider the sequence which the lasers must switched off in order for the prisoner to meet the first 2 conditions

Timing of the Lasers

Laser One		Laser Two		Laser Three	Laser Four	Laser Five			
0		0		0	0	0			
3	48	2	32	5	4	1	16	31	46
6	51	4	34	10	8	2	17	32	47
9	54	6	36	15	12	3	18	33	48
12	57	8	38	20	16	4	19	34	49
15	60	10	40	25	20	5	20	35	50
18		12	42	30	24	6	21	36	51
21		14	44	35	28	7	22	37	52
24		16	46	40	32	8	23	38	53
27		18	48	45	36	9	24	39	54
30		20	50	50	40	10	25	40	55
33		22	52	55	44	11	26	41	56
36		24	54	60	48	12	27	42	57
39		26	56		52	13	28	43	58
42		28	58		56	14	29	44	59
45		30	60		60	15	30	45	60

Q2. He waited for 33 minutes.

Q3. He cleared the final door at the 37 minutes.

Q4. He spent 4 minutes.

Q5. He will have 23 minutes.

This question is an example (a very extreme and unusual one) of real life problem solving using mathematics.

Q6. Can you create a similar problem for your friend to solve?