

1. Shown below is Google’s COVID-19 data as of November 2020.

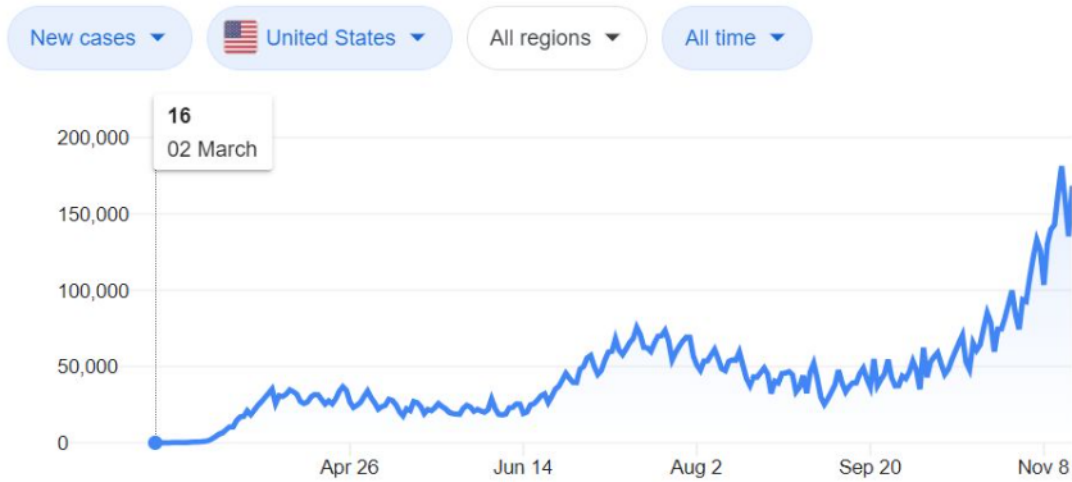


Fig 1. The number of new coronavirus cases in the United States.





















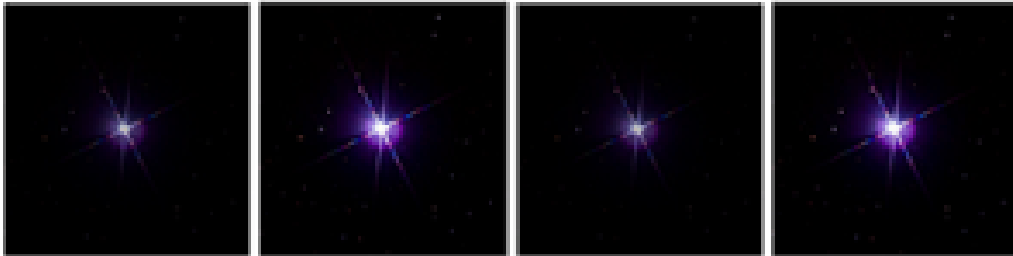
Location	Total cases ↓	New cases (1 day*)	New cases (last 60 days)	Cases per 1M people
 Worldwide	55,074,994	No data		7,083
 United States	11,279,503	166,581		34,226
 India	8,873,541	28,414		6,522
 Brazil	5,876,464	13,371		27,806
 France	1,992,552	9,072		29,706
 Russia	1,932,711	22,562		13,171
 Spain	1,496,864	38,273		31,780
 United Kingdom	1,390,681	21,363		20,933
 Argentina	1,318,384	7,893		29,337
 Italy	1,205,881	27,352		20,017

Fig 2. The worldwide statistics of new coronavirus cases.

Which of the following conclusions is the most false?

- A. Italy has over one million cases in total
- B. There are fewer than 100,000 new cases per day in the United States
- C. The number of new cases have been decreasing in India over the last two months
- D. The number of new cases is increasing worldwide

2. An astronomer observing a newly discovered star notices that it dims for 21 seconds, then brightens for 15 seconds, then dims again for 21 seconds, and so on periodically. The dimming / brightening pattern:



After 199 minutes, how many times has the star brightened after dimming?

- A. 119
 - B. 109
 - C. 129
 - D. 99
3. Engineers in Space X are experimenting with a new system of navigation based on the 3D system of coordinates (x, y, z) with one unit equal to 10 00 km. In this system of coordinates $(0, 0, 0)$ is the Earth. Logblock (flight log) of the satellite has the following records:

Day of the flight:	Vector of displacement:
Day 1	$(3, 4, 8)$
Day 2	$(-4, 7, -12)$
Day 3	$(-4, -13, 18)$
Day 4	$(3, 0, -10)$

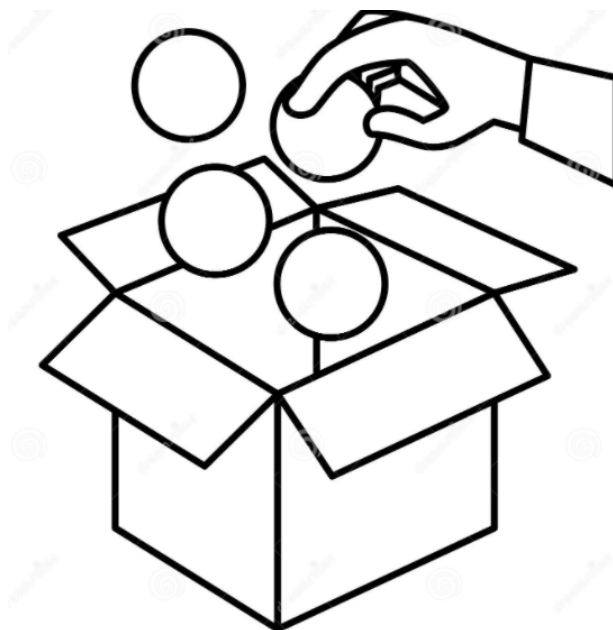
How far is the satellite at the end of the fourth day?

- A. 225 600 km
 - B. 104 400 km
 - C. 360 000 km
 - D. 60 000 km
4. For a positive integer n , we write $?(n)$ to say how many positive divisors n has. For example, because 6 has four divisors, which are 1, 2, 3, and 6, we have $?(6) = 4$. Three positive integers a, b, c are given such that the sum $?(a) + ?(b) + ?(c)$ is an even number.

What is the smallest possible value of $a + b + c$?

- A. 2
- B. 3
- C. 4
- D. 5

5. In a game show, the contestant is asked to take out some balls out of a jar without looking. If he/she takes at least 19 balls of the same color, then he/she wins \$20 000. However, taking each ball comes with a cost of \$10. For example, if the contestant takes 19 balls and, being extremely lucky, the 19 balls are all the same color, then he/she wins \$20000 but has to pay \$190 for the balls, netting him/her \$19 810



It is known that the jar contains exactly 100 golden balls and 100 silver balls. The contestant wants to be absolutely sure that he/she gets at least 19 balls of the same color, but doesn't want to pay too much for the balls.

What is the smallest number of balls that the contestant should take?

- A. 13
- B. 19
- C. 37
- D. 51

Answers

1. B
2. A
3. D
4. C
5. C