1. Assume that the Age 0 cohort of the following year arises from live births in the current year, and that there is no migration of Age 0.

   Given that:
   - the number of live births in the current year is 5000,
   - the Sex Ratio at Birth is 850 male babies per 1000 female babies,

   the Age 0 female population (rounded off to whole number) for the following year is:

   (A) 750
   (B) 2297
   (C) 2703
   (D) 4150
   (E) 4250

   Ans:
   Apply Sex Ratio at Birth: Number of female live births = 5000 x 1000/(850+1000) = 2703. (C)

2. Assume that the Age X cohort of the following year arises from those who are Age (X-1) in the current year, minus deaths of Age (X-1), plus migration of Age X.

   Given that:
   - the Age (X-1) cohort of the current year is 1000,
   - the Age (X-1) death rate is 23 per 1000,
   - the Age X migration rate is 36 per 1000,

   the Age X population (rounded off to whole number) for the following year is

   (A) 941
   (B) 1012
   (C) 1013
   (D) 1059
   (E) None of the above

   Ans: Apply death rate and migration rate: 1000 x (1 – 23/1000) x (1 + 36/1000) = 1012. (B)

3. A policy-maker hopes to maintain a reasonable Old-Age Support Ratio (OASR) by changing the retirement age. When pegged to the retirement age X, the OASR(X) is defined to be the ratio of the population of the 20 to (X-1) age group to that of the ≥ X age group.

The population size of different age groups is shown below:

Age Group	0-19	20-64	65-70	71	72	73	74	75	76	77	≥78
Population Size	1769000	2473800	341400	54400	49900	45600	41200	39800	36600	34500	288300

i) At what retirement age will the OASR be closest to 4.8?

a. 70
b. 71
c. 72
d. 73
e. None of the above

if retirement age is 65

$$\text{OASR} = \frac{2473800}{341400+54400+49900+45600+41200+39800+36600+34500+288300} = \frac{2473800}{931700} = 2.66$$

if retirement age is 71

$$\text{OASR} = \frac{2473800+341400}{54400+49900+45600+41200+39800+36600+34500+288300} = \frac{2815200}{590300} = 4.77$$

if retirement age is 72

$$\text{OASR} = \frac{2473800+341400+54400}{49900+45600+41200+39800+36600+34500+288300} = \frac{2869600}{535900} = 5.35$$

if retirement age is 73

$$\text{OASR} = \frac{2473800+341400+54400+49900}{45600+41200+39800+36600+34500+288300} = \frac{2919500}{486000} = 6.01$$

Cannot calculate OASR(70) without assuming that the numbers drop evenly over the 5 years. 70 is part of the 5 year age group. OASR(65) is already calculated.
OASR(X) increases as X increases.

4. Scientists have found a new species of organisms known as *Kurosanya*. Every 1 year, two new Kurosanyas are born for every existing Kurosanya. At the same time, every 1 year, the probability of a Kurosanya dying is 50%. The "birth rate" and "death rate" of Kurosanya are:

    a. 2 births per 1000, 0.5 deaths per 1000
    b. 2 births per 1000, 500 deaths per 1000
    c. 2 births per 1000, 1500 deaths per 1000
    d. 2000 births per 1000, 500 deaths per 1000
    e. 2000 births per 1000, 1500 deaths per 1000

Every 1 year, the original bacteria will produce (give birth to) 2 new bacteria. → Every 1 year, the 1000 bacteria will produce (give birth to) 2000 new bacteria

Every 1 year, the probability of any of the bacteria dying is 50%. → Every 1 year, roughly 500 bacteria will die per 1000 bacteria

5. The following Excel file gives the marriage rate (MR) and birth rate (BR) data for the years 2000—2013, with the two rates defined as below:

	A	B	C	D	E	F
1	Marriage Rate (**MR**) = Number of marriages per 1000 residents					
2	Birth Rate (**BR**) = Number of live births per 1000 residents					
3			**MR**		**BR**	
4	2000		6.7		13.7	
5	2001		6.5		11.8	
6	2002		6.6		11.4	
7	2003		6.3		10.5	
8	2004		6.3		10.3	
9	2005		6.4		10.2	
10	2006		6.5		10.3	
11	2007		6.4		10.3	
12	2008		6.5		10.2	
13	2009		6.6		9.9	
14	2010		6.1		9.3	
15	2011		6.7		9.5	
16	2012		6.7		10.1	
17	2013		6.3		9.3	
18						

Your friend observes that there is positive correlation between MR and BR of the same year. But he wonders if more marriages in one year might lead to more births in the next year, and suggests to you to calculate not the correlation between MR and BR of the same year, but rather between MR of one year and BR of the next year. Which of the EXCEL formulas below would be appropriate for this calculation?

A. =CORREL(C4:C17,E4:E17)
B. =CORREL(C4:C16,E5:E17)
C. =CORREL(C4:C16,E4:E17)
D. =RSQ(C4:C17,E4:E17)
E. None of the above

Since we want the correlation between MR of one year and BR of the next year, we calculate the correlation between MR from 2000-2012 vs BR from 2001-2013. This is given by option (B).