

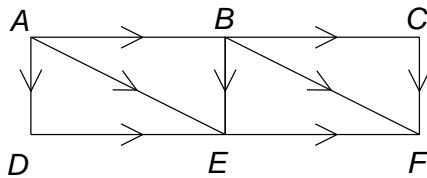
Indices (S UKMT)

These questions must be attempted **without a calculator**

Topics covered in the questions below may not necessarily be from the topic of the title.

1. What is the mean of the five numbers 1^5 , 2^4 , 3^3 , 4^2 and 5^1 ?
- A 6.2 B 11.4 C 12.2 D 13 E 13.8

2. The engineering company, Sparks and Tensor, has a complicated system of conveyor belts in its factory. Components must travel along these belts in the directions shown by the arrows.



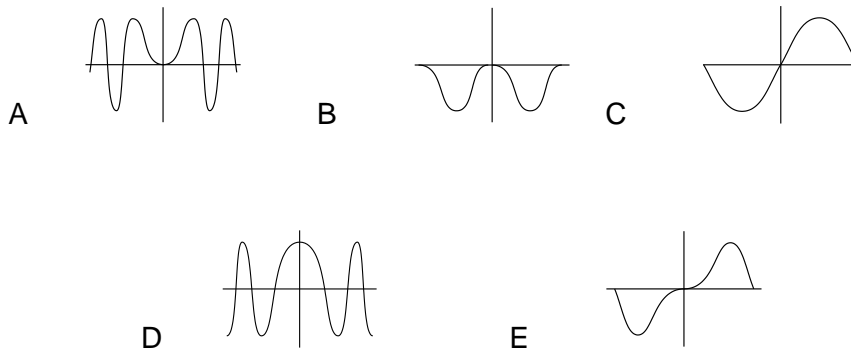
How many different routes are there from A to F along the conveyor belts?

- A 4 B 5 C 6 D 7 E 8
3. Which of the five expressions shown has a different value from the other four?
- A 2^8 B 4^4 C $8^{8/3}$ D 16^2 E $32^{6/5}$
4. Which of these five expressions represents the largest number?
- A $9^{(9^9)}$ B 999 C 9^{99} D $(9^9)^9$ E 99^9
5. If $x = (1/4)^{1/2}$, what is the value of x^{-x} ?
- A 1/4 B 1/2 C $1/\sqrt{2}$ D $\sqrt{2}$ E 2
6. What is the value of $(61^2 - 39^2) \div (51^2 - 49^2)$?
- A 10.5 B 11 C 12 D 21 E 22
7. Observe that $2000 = 2^4 \times 5^3$. What is the number of the next year after the year 2000 which can be written $a^b \times c^d$ where a, b, c, d are 2, 3, 4, 5 in some order?
- A 2016 B 2025 C 2040 D 2048 E 2050

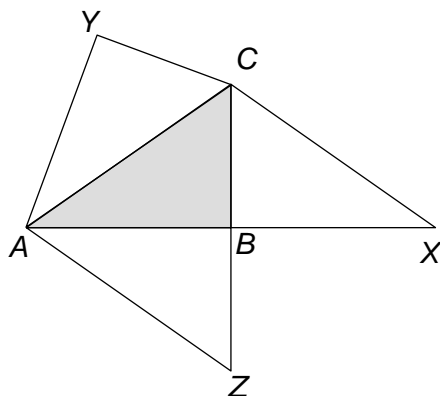
8. When $n = 81$, what is the value of $\frac{n^{20}}{3^n}$?
- A less than $\frac{1}{100}$ B $\frac{1}{3}$ C 1 D 3 E more than 100

9. Sam correctly calculates the value of $5^8 \times 8^5$.
How many digits does her answer contain?
- A 11 B 12 C 13 D 14 E 15

10. Which of the following could be the graph of $y = \sin(x^2)$?



11. The figure shows a hexagon $AZBXCY$ made from four congruent tiles. The shape and position of the tiles are given by triangle ABC and the three reflections of triangle ABC in the lines determined by its sides. For example, ABZ is the image of ABC when reflected in the line determined by AB . If a polygon is made from five tiles whose shape and position are determined by a quadrilateral and the four reflections of that quadrilateral in the lines determined by its sides, what is the smallest possible number of sides of the resulting polygon?



- A 4 B 5 C 6 D 7 E 8
12. For how many values of n are both n and $4\left(\frac{n-1}{n+1}\right)$ integers?
- A 1 B 2 C 3 D 4 E 5