

1. [Number Theory, 3 Points]

For the integers x and y ,

$$3 \leq x \leq 5$$

$$1 \leq x \cdot y \leq 60$$

What is the number of ordered pairs (x, y) satisfying given conditions above?

- A) 39 B) 41 C) 43 D) 45 E) 47

2. [Combinatorics, 3 Points]

In how many ways can 3 different pencils be distributed to 4 students so that every student gets **at most** one pencil?

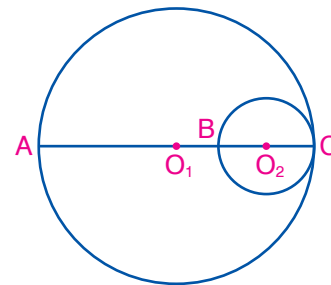
- A) 4 B) 6 C) 24 D) 48 E) 72

3. [Geometry, 3 Points]

The circles with centers O_1 and O_2 in the figure are tangent at point C . Points $A, O_1, B, O_2,$ and C are collinear.

$$O_1O_2 = 10 \text{ cm}$$

What is $AB = x$?

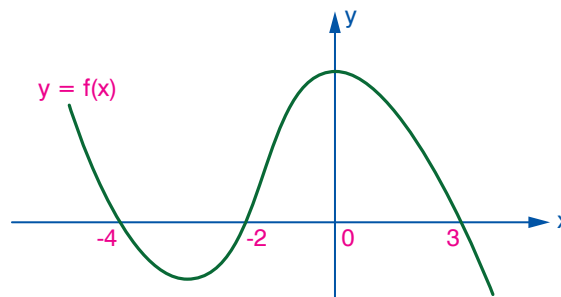


- A) 20 cm B) 17.5 cm C) 15 cm D) 14 cm E) 12.5 cm

4. [Algebra, 3 Points]

The graph of the function $y = f(x)$ is given.

Which of the following is the solution of the inequalities $f(x) < 0$?



- A) $(-\infty, -4) \cup (-2, 3)$ B) $(-4, -2) \cup (3, \infty)$ C) $(-4, -2) \cup (-2, 3)$
D) $(-\infty, -4) \cup (3, \infty)$ E) $(-2, 3) \cup (3, \infty)$

5. [Algebra, 5 Points]

Order the expressions by choosing $<$, $>$, or $=$ for the symbols \square .

$$3^5 \times 4^5 \square 12^5$$

$$3^5 \times 3^4 \square 4^7$$

$$3^4 \times 4^5 \square 12^4$$

A) $<$, $>$, $=$

B) $=$, $<$, $>$

C) $=$, $>$, $>$

D) $<$, $>$, $>$

E) $<$, $=$, $>$

6. [Number Theory, 5 Points]

For distinct positive integers a , b , and c ,

$$\frac{a}{5} < \frac{b}{12} < \frac{c}{10}$$

What is the **minimum** value of $a + b + c$?

A) 6

B) 7

C) 8

D) 9

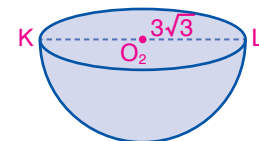
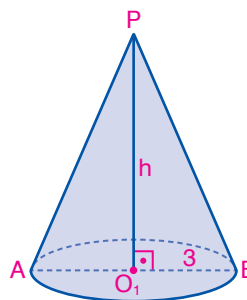
E) 10

7. [Geometry, 5 Points]

The cone in the figure has the same volume as hemisphere.

Which of the following is equal to the height of the cone?

$$O_1B = 3 \text{ cm} \text{ and } O_2L = 3\sqrt{3} \text{ cm}$$



A) $18\sqrt{3}$ cm

B) $12\sqrt{3}$ cm

C) 12 cm

D) $6\sqrt{3}$ cm

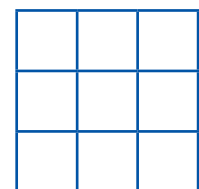
E) 6 cm

8. [Combinatorics, 5 Points]

Each identical square will be filled by using one of 5 different symbols

❖, ⚙, ✉, □, ⌘.

In how many ways can squares be filled, if no two squares with a common vertex or with a common edge can contain the same symbols?



A) 5760

B) 8640

C) 11,520

D) 12,960

E) 25,920

9. [Algebra, 7 Points]

Find the sum.

$$\frac{1}{2} + \left(\frac{1}{3} + \frac{2}{3}\right) + \left(\frac{1}{4} + \frac{2}{4} + \frac{3}{4}\right) + \left(\frac{1}{5} + \frac{2}{5} + \frac{3}{5} + \frac{4}{5}\right) + \dots + \left(\frac{1}{100} + \frac{2}{100} + \frac{3}{100} + \dots + \frac{99}{100}\right)$$

A) 2525

B) 2500

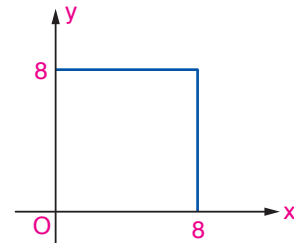
C) 2475

D) 2375

E) 1250

10. [Geometry, 7 Points]

Line ℓ with slope $-\frac{1}{4}$ is passing through the point $(a, 0)$ and divides the given square into two regions of equal area.

What is a ?

A) 12

B) 14

C) 16

D) 18

E) 20