

1. [Number Theory, 3 Points]

For the prime numbers a and b ,

\overline{ab} is the greatest two-digit number that is the product of powers of a and b , and

$\overline{a^2b}$ is the least three-digit number that is the product of powers of a and b .

For example, $\overline{37} = 3^4 \cdot 7^0 = 81$ and $\overline{37} = 3^1 \cdot 7^2 = 147$.

What is the value of $\overline{35} - \overline{23}$?

- A) 22 B) 29 C) 35 D) 39 E) 47

2. [Combinatorics, 3 Points]

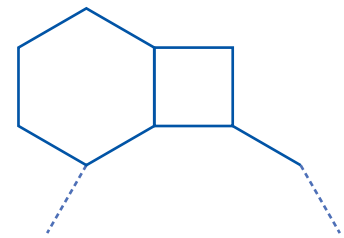
In how many ways can two meetings be scheduled on different days between Monday, November 16th, 2020 and Sunday, November 29th, 2020, if at least one meeting will be on weekdays?

- A) 70 B) 75 C) 80 D) 85 E) 90

3. [Geometry, 3 Points]

A regular polygon is surrounded by a set of regular hexagons and squares with a common side.

What is the number of sides of the regular polygon?



- A) 10 B) 12 C) 15 D) 16 E) 18

4. [Algebra, 3 Points]

Positive real numbers a and b are the solutions of the quadratic equation,

$$2ax^2 - 5bx + 8b = 0.$$

What is $a + b$?

- A) 5 B) 6 C) 10 D) 12 E) 15

5. [Combinatorics, 5 Points]

Anna takes Math Test with two sections of 4 questions each. To pass the test, she needs to answer at least,

- 2 questions correctly in each section.
- 5 questions correctly in total.

Anna selects 5 out of these 8 questions randomly and answered all of them correctly. What is the probability that Anna passes this test?

- A) $\frac{3}{4}$ B) $\frac{4}{5}$ C) $\frac{5}{6}$ D) $\frac{7}{8}$ E) $\frac{6}{7}$

6. [Algebra, 5 Points]

Graph of the function $f(x)$ for the domain $[-5, 5]$ is given.

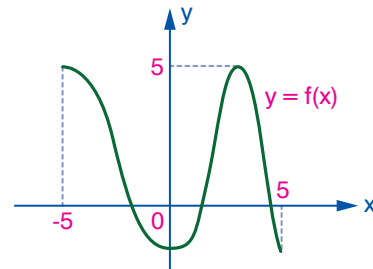
$a, b, c,$ and d are distinct numbers in this domain.

$f(a) = f(b) = 1$

$f(c) = f(d) = 3$

Which of the following can be true for $a, b, c,$ and d ?

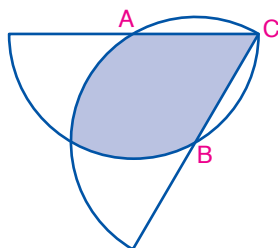
- I. $a < b < c < d$
- II. $c < a < b < d$
- III. $c < d < a < b$



- A) Only I B) Only II C) Only I and II D) Only II and III E) I, II and III

7. [Geometry, 5 Points]

\overline{AC} is the radius of the circle with center A, \overline{BC} is the radius of the circle with center B. Point B is on the circle with center A, and point A is on the circle with center B.



$AC = BC = 12 \text{ cm}$

What is the area of the shaded region?

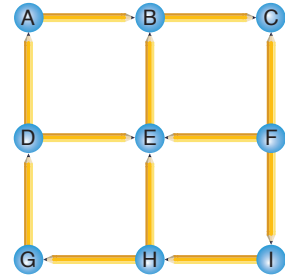
- A) $36\pi \text{ cm}^2$ B) $42\pi \text{ cm}^2$ C) $48\pi \text{ cm}^2$ D) $54\pi \text{ cm}^2$ E) $60\pi \text{ cm}^2$

8. [Number Theory, 5 Points]

Digits from 1 to 9 are placed in each circle placed between 12 pencils. Any number placed at the leaf of a pencil is greater than the number at the eraser.

For example, the number B is greater than the number A.

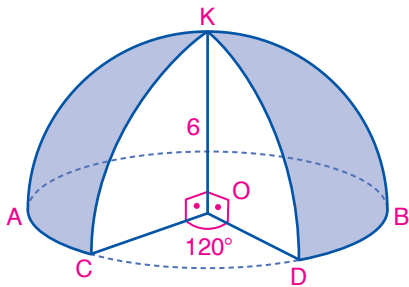
What is the sum of the numbers placed at circles A, E and G?



- A) 13 B) 14 C) 15 D) 16 E) 17

9. [Geometry, 7 Points]

In the given figure, one third of the hemisphere with center O is cut out.



$\overline{OK} \perp \overline{OC}$,
 $\overline{OK} \perp \overline{OD}$,
 $m\angle(COD) = 120^\circ$, and
 $OK = 6$ cm.

What will be surface area of the remaining solid figure?

- A) 90π cm² B) $60\pi + 36$ cm² C) 80π cm² D) $70\pi + 36$ cm² E) 72π cm²

10. [Algebra, 7 Points]

$a_n = \frac{n^2 + 1}{2n + 1}$ is the general term of a sequence.

If $\frac{10}{3}$ is one of the terms of the sequence, then what is the next term?

- A) $\frac{65}{17}$ B) $\frac{16}{9}$ C) $\frac{26}{11}$ D) $\frac{37}{13}$ E) $\frac{122}{23}$