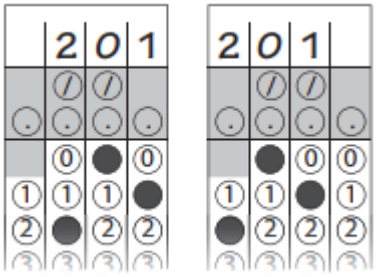
## DO NOT TURN TO THE NEXT PAGE until your proctor tells you.

## Please read the directions carefully.

- You have **100 minutes** for **40 Problems**.
- Mark your answers on your Answer Form with a pencil.
- Extra scratch paper is neither given nor allowed. You may use blank pages in the booklet as scratch paper.
- There are no penalties for incorrect answers. Answer as many problems as you can; return to the others in the time you have left for the test.
- Calculators are not permitted. Cell phones must be turned off completely and placed out of sight.
- The problems are divided into three categories, Part **A**, Part **B** and Part **C**, according to difficulty level. A correct answer for a Part A problem is worth 3 points, Part B is worth 5 points, and Part C is worth 7 points. Each problem is a multiple-choice problem except the last four problems in Part C.
- Problems 37-40, the last four problems of Part C, are constructed-response problems. Enter your numerical answer in the grid on your answer sheet as shown on the right.

  1. Although not required, it is suggested that you write your answer from left to right in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
  2. Mark no more than one circle in any column.
  3. You may start your answers in any column, space permitting. Columns you don't use should be left blank, and there should be no blank columns between columns that are not blank. For example, if your answer is 201, then either arrangement of filled-in circles shown below is acceptable.
     For example: Answer: 201 – either position is correct.




  4. No problem has a negative answer.

- **Notations in Geometry Problems:**

| | |
|---|---|
| $A$ | : Point $A$ |
| $\overleftrightarrow{AB}$ | : Line through points $A$ and $B$ |
| $\overline{AB}$ | : Line segment joining $A$ and $B$ |
| $AB$ | : Length of the line segment $\overline{AB}$. |
| $\angle ABC$ | : Angle with the vertex point at $B$ |
| $m\angle ABC$ | : Measure of $\angle ABC$ |
| $\perp$ | : Perpendicular |
| $//$ | : Parallel |

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**Problem 1**

| Algebra |
| --- |
| 3 points |

Suppose $x + \dfrac{1}{y} = 3.125$. Find the decimal equal to $\dfrac{y}{xy+1}$.

A) 0.25

B) 0.32

C) 0.80

D) 1.25

E) 3.35

**Problem 2**

| Geometry |
| --- |
| 3 Points |

The lengths, in inches, of the sides of the equilateral triangle are $a + 2b$, $3a - b$, and $5b - a$. Which of the following **could not** be the values of $a$ and $b$?

A) $(12, 8)$

B) $\left(\dfrac{9}{2}, 3\right)$

C) $(10, 6)$

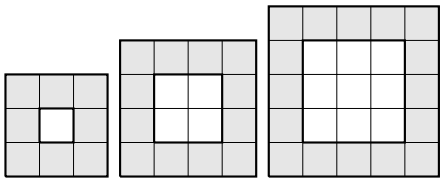
D) $(3, 2)$

E) $\left(\dfrac{3}{2}, 1\right)$

**Problem 3**

Algebra
5 Points

The pictures on the right show a 3 by 3 grid, a 4 by 4 grid, and a 5 by 5 grid, each with shaded borders. How many square units are in the shaded border of a 101 by 101 grid?



A) 396

B) 400

C) 698

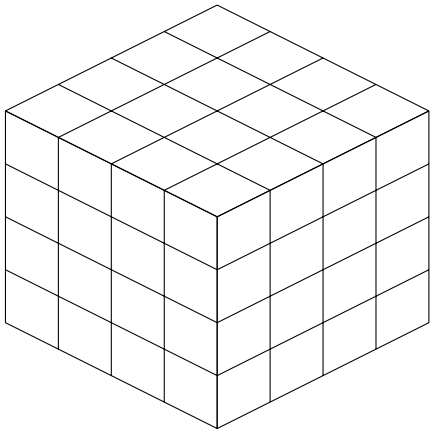
D) 704

E) None of the preceding

**Problem 4**

Combinatorics
5 Points

The big cube is made up 64 white small cubes. All the faces of the big cube are then painted in red. How many of the small cubes have exactly two painted red faces?



A) 28

B) 20

C) 12

D) 10

E) None of the preceding

**Problem 5**

| Algebra |
| --- |
| 5 Points |

When an empty jar is filled with water, it weights 6 pounds. When 3/7 of the water is poured out, the jar weights 4 pounds. How much does the empty jar weight in pounds?

A) $\frac{4}{3}$

B) $\frac{3}{2}$

C) $\frac{5}{3}$

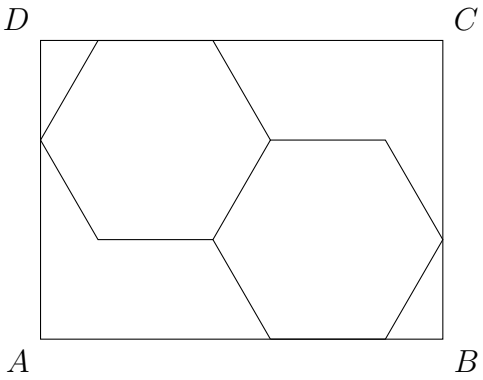
D) 2

E) $\frac{5}{2}$

**Problem 6**

| Geometry |
| --- |
| 5 Points |

Suppose $ABCD$ is a rectangle with two identical regular hexagons. If the area of one hexagon is 6 unit squares, then find the area of the rectangle in unit squares.




A) 18

B) 21

C) 24

D) 27

E) None of the preceding

**Problem 7**

| Algebra |
| --- |
| 7 Points |

Suppose $a$ and $b$ represent positive numbers. Of the two numbers, $a$ is the smaller and $b$ the larger. What number represents the point two third of the way between $a$ and $b$ on a number line?

A) $\frac{a+b}{3}$

B) $\frac{a+2b}{3}$

C) $\frac{3a+b}{3}$

D) $\frac{2a+2b}{3}$

E) None of the preceding

**Problem 8**

| Number Theory |
| --- |
| 7 Points |

How many two-digit positive integers have at least one digit that is a 8?

A) 17

B) 18

C) 19

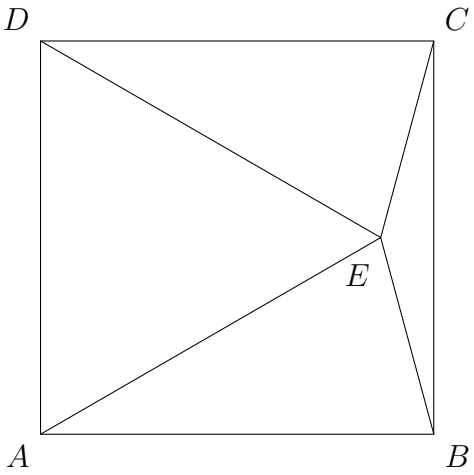
D) 20

E) 21

**Problem 9**

| Geometry |
| --- |
| 7 Points |

Equilateral triangle $EAD$ shares a side with square $ABCD$. What is the sum of $m\angle CEB$ and $m\angle AEB$?




A) 195°

B) 200°

C) 215°

D) 225°

E) 245°

**Problem 10**

| Number Theory |
| --- |
| 7 Points |

How many whole numbers from 1 to 1000 (including 1 and 1000) do not contain the digit 1?

# MathCon grade 5 sample Contest

**1.**

The time 11 hours after 11 AM is also the time 11 hours before

A. 10 AM
B. 9 AM
C. 12 PM
D. 11 AM

---

**2.**

A and B are two different numbers selected from the first 100 counting numbers from 1 to 100.

What is the largest value that $\frac{A+B}{A-B}$ can have?

A. 199
B. 197
C. 198
D. 200

---

**3.**

Sum of the ages of John and Davis is 41. What will be the sum of their ages in 10 years?

A. 61
B. 66
C. 56
D. 51

---

**4.**

The sum of two consecutive whole numbers is 2015. What is the difference between these two numbers?

A. 2015
B. 2014
C. 1
D. 3

---

**5.**

A doctor gives you five pills telling you to take one every half hour.
How many hours would the pills last?

A. $2\frac{1}{2}$ hours
B. $3\frac{1}{2}$ hours
C. 3 hours
D. 2 hours

**6.**

$$\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}=?$$

A. 2
B. 4
C. 8
D. 1

---

**7.**

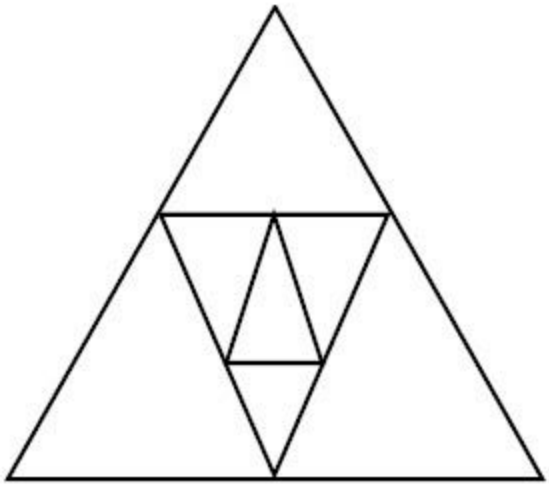
A 12-hour clock loses 20 minutes each day. The clock will first return to the correct time in

A. 24 days
B. 18 days
C. 12 days
D. 36 days

---

**8.**

How many different triangles does this diagram contain?



A. 12 triangles
B. 6 triangles
C. 3 triangles
D. 9 triangles

---

**9.**

$(36 \times 25 \times 72 \times 18 \times 45)$ *divided by* $(18 \times 72 \times 45 \times 18 \times 25) = ?$

A. 2
B. 36
C. 1
D. 18

---

**10.**

A lily pad doubles in size each day. In 20 days the lily pad will cover the entire pond.
In how many days will the pond be half covered?

A. 15 days
B. 19 days
C. 10 days
D. 29 days

---

**11.**

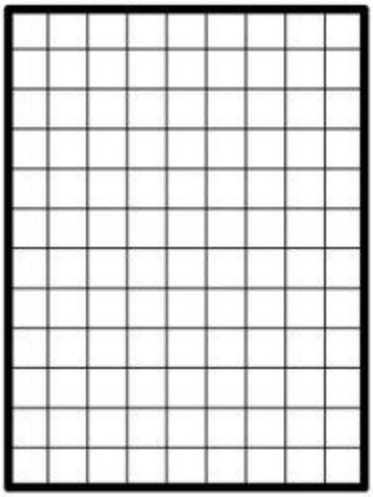
If 12 is added to half of a number, the result is equal to the twice that number.
What is the number?

A. 8
B. 10
C. 6
D. 4

---

**12.**

Bob is putting a low fence around all four sides of a rectangular garden. The garden is 9 feet wide and 12 feet long.



Each section of fencing is 3 feet long. How many sections of fencing will Bob need?

A. 14 sections
B. 40 sections
C. 24 sections
D. 10 sections

---

**13.**

What is the sum of the counting numbers from 1 to 30? (including 1 and 30)

A. 460
B. 465
C. 475
D. 450

---

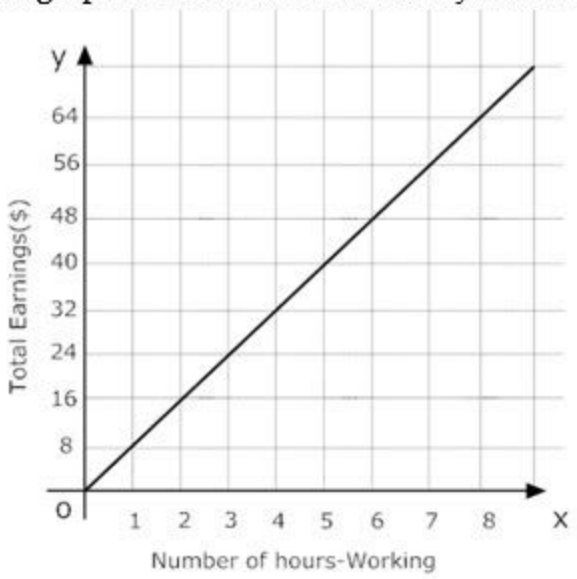
**14.**

Suppose today is Tuesday. What day of the week will it be 50 days from now?

A. Thursday
B. Friday
C. Tuesday
D. Wednesday

**15.**

The graph shows how much money Karen makes in a fast-food restaurant.



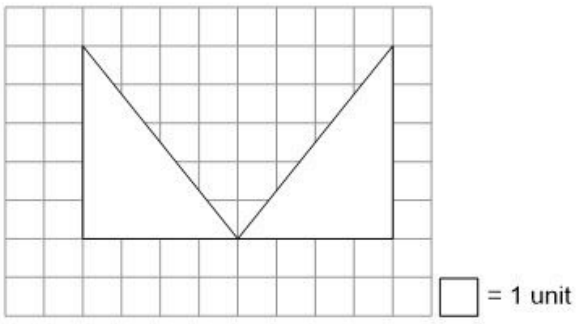

If Karen works 24 hours in total, how much money will she have?

A. $192
B. $178
C. $204
D. $224

---

**16.**

Two triangles area shown on the grid.




Which expression represents the total area of these two triangles?

A. 5+5

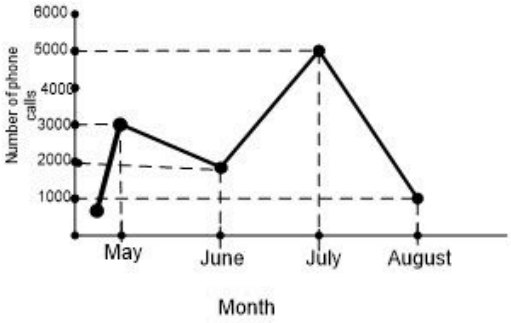
B. 20

C. 4+4

D. 12

**17.**

Use the graph of the number of phone calls received by a customer service center.




About how many more people call the service in July than in June?

A. 3000 people

B. 2500 people

C. 2000 people

D. 1000 people

---

**18.**

How much should I pay for a 21 minute phone call that costs $5 for the first minute and 15 cents for each additional minute?

A. $8.50
B. $8.00
C. $7.50
D. $7.00

---

**19.**

Which problem situation is represented by the equation:

$$35 + 2x = 175?$$

A. Tim has $35. He started with $175. Each of his 2 friends gave him the same amount of money (x). How much money did each friend give Tim?

B. Tim has $35. He gave each of his 2 friends the same amount of money (x). How many friends have $175?

C. Tim has $175. He started with $35. Each of his 2 friends gave him the same amount of money (x). How much money did each friend give Tim?

D. Tim has $175. He gave each of his 35 friends the same amount of money (x). How much money did Tim give to each friend?

**20.**

Mary is simplifying fractions. Which whole number should she use to simplify $\frac{36}{54}$ to lowest terms?

A. 6
B. 9
C. 18
D. 24

---

**21.**

Which of the following is the five-digit number ABCDE such that $ABCDE \times 4 = EDCBA$

A. 21657
B. 21978
C. 12546
D. 21376

---

**22.**

How many months in year has 30 days?

A. 4
B. 6
C. 8
D. 11

---

**23.**

Which letter should be in the last box?

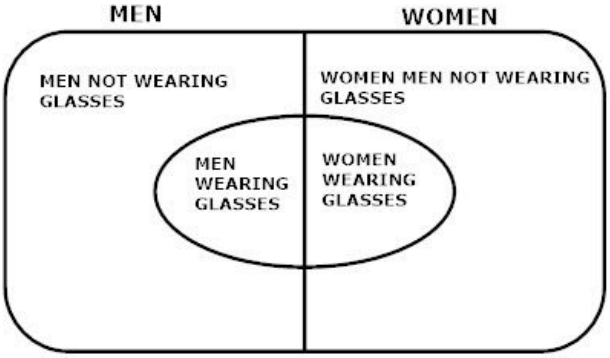
| | | | | | | |
|---|---|---|---|---|---|---|
| **O** | **T** | **T** | **F** | **F** | **S** | **?** |

A. K
B. L
C. S
D. E

---

## 24.

In group of 37 people, there are 22 women. Of this 37 people, 18 people wear glasses. Given that 30 people are either women, or wearing glasses, then how many men do not wear glasses?




A. 5
B. 6
C. 7
D. 8

---

## 25.

On a no wind day, an airplane is flying 2000 miles round trip from Chicago to Boston and back to Chicago with constant speed of 500 mph. About how long would it take to fly the same round trip if there is a wind speed of 100 mph from Chicago to Boston during the whole round trip flight?

A. 4 hours and 10 minutes
B. 3 hours and 50 minutes
C. 4 hours and 20 minutes
D. 3 hours and 40 minutes

---

## 26.

In a ticket line for NBA Finals, on average it takes 1 minute per person to purchase ticket.
Adam is the 8$^{th}$ person from the beginning in the line.
Within five minutes, three more fans join the end of the line and Adam is now the 7$^{th}$ person from the end.

When the last person out of the three fans join the line, how many people would be in front of this person?

A. 7
B. 8
C. 9
D. 11

**27.**

How many three digit numbers with all digits different are there with the following two conditions?

i. The digits in the hundreds place and the ones places are both even.
ii. The digit in the tens place is odd.

A. 125
B. 100
C. 96
D. 80

---

**28.**

John is randomly opening the book he has been reading recently. If the sum of the page numbers on both pages is 85, what is their multiplication?

A. 1,052
B. 1,132
C. 1,722
D. 1,806

---

**29.**

What is the value of $\dfrac{2010+\dfrac{2009}{2}+\dfrac{2011}{2}}{2010}$ ?

A. 2010
B. 2
C. $\frac{3}{2}$
D. $\frac{1}{2}$

---

**30.**

John is 24 years younger than his dad and also John's mom is twice older than him.

5 years ago, John's age was equal to the $\frac{1}{6}$ times the sum his mother and father's current age.

How old is John today?

A. 21
B. 20
C. 19
D. 18

---

**31.**

The sum of four consecutive odd integers is 80.
Which of the following is the largest one of these four numbers?

A. 15
B. 17
C. 21
D. 23

---

**32.**

A cookie recipe uses six times flour as sugar. Also, the ratio of flour to butter is 3 to 1.
If the total ingredient is 540 grams, how much flour are in these cookies?

A. 480 grams
B. 420 grams
C. 360 grams
D. 300 grams

---

**33.**

$A$ and $B$ are five-digit numbers with

$$A = 3m2n5$$

$$B = 2m3n6$$

Which of the following is equal to $A - B$ ?

A. 9,899
B. 9,099
C. 899
D. 809

---

**34.**

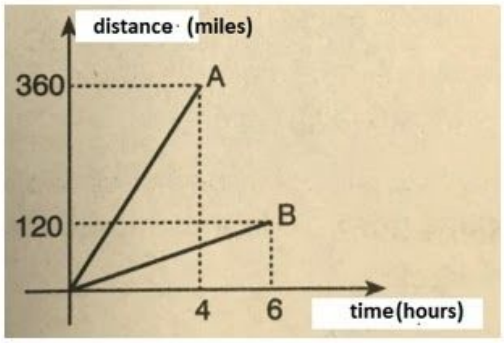
What is the value of $\dfrac{\left(1-\frac{1}{2}\right)\div\left(1+\frac{1}{2}\right)}{\left(2-\frac{1}{2}\right)\cdot\left(2+\frac{1}{2}\right)}$ ?

A. $\frac{4}{45}$
B. $\frac{1}{15}$
C. $\frac{2}{45}$
D. $\frac{4}{15}$

---

**35.**

Two cars, A and B, are driving toward each other from opposite directions, starting at two different cities 560 miles away. In how many hours will they meet?




A. 3 hours
B. 5 hours
C. 7 hours
D. 9 hours

---

**36.**

Helen is five years older than Adam. Also, Adam is half as old as Helen. How old is Helen?

A. 5
B. 10
C. 12
D. 14

---

**37.**

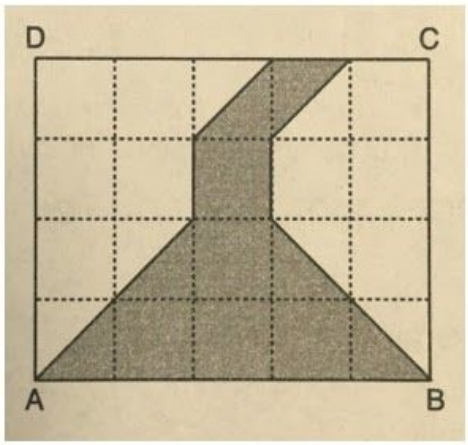
Three years ago, Michael was three times as old as his sister, Jane. Five years from now, he will be twice as old Jane. How old is Michael now?

A. 23 years old
B. 24 years old
C. 26 years old
D. 27 years old

---

## 38.

Which of the following is equal to the ratio of the area of the shaded region to the area of the rectangle ABCD.




A. $\frac{1}{2}$

B. $\frac{2}{5}$

C. $\frac{3}{8}$

D. $\frac{3}{5}$

---

## 39.

In three years, I will be three times as old as I was three years ago. How old am I?

A. 5
B. 6
C. 7
D. 8

---

## 40.

In a classroom, 13 students speak English, 15 students speak French and 8 students speak both languages.

If 3 students speaks neither English nor French, how many students are in this class?

A. 23 students
B. 24 students
C. 25 students
D. 26 students

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- Calculators are not permitted. Cell phones must be turned off completely and placed out of sight. MathCON problems are ALL done without a calculator.
- The problems are divided into three categories by difficulty levels:
  3 Points (Questions 1-8)
  5 Points (Questions 9-24)
  7 Points (Questions 25-32)
- Problems 29-32, the last four problems are constructed-response problems. Enter your numerical answer in the grid on your answer sheet as shown on the right.
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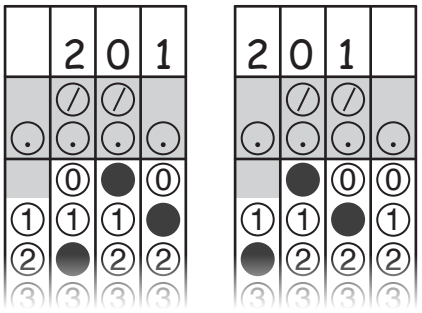


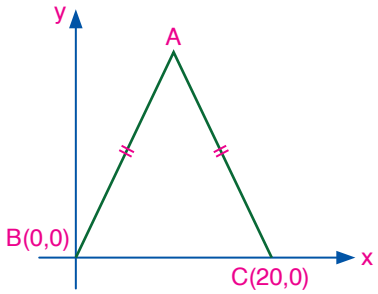

  4. No problem has a negative answer.

- Notations in Geometry Problems:

| | |
|---|---|
| A | : Point A |
| $\overleftrightarrow{AB}$ | : Line through points A and B |
| $\overline{AB}$ | : Line segment joining A and B |
| AB | : Length of the line segment AB |
| $\angle ABC$ | : Angle with the vertex point at B |
| $m\angle ABC$ | : Measure of angle ABC |
| $\perp$ | : Perpendicular |
| // | : Parallel |

**2.** [Geometry, 3 Points]

In the given figure,




ABC is an isosceles triangle,
with area 120 square units.
If B(0, 0) and C(20, 0) are the vertices of the base,
then what is the y-coordinate of point A?

A) 10 B) 12 C) 16 D) 18 E) 24

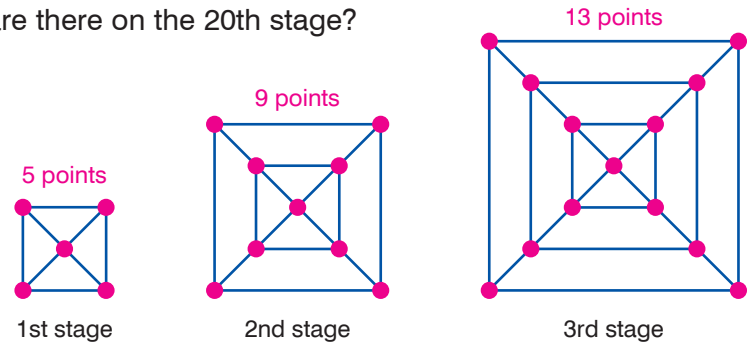
**16.** [Combinatorics, 5 Points]

The first six prime numbers are written on the sides of a die.
Which of the following sums would **not** be possible if the die was rolled three times and the numbers were added?


A) 10 B) 17 C) 26 D) 30 E) 31

**21.** [Algebra, 5 Points]

How many points are there on the 20th stage?




A) 73 B) 77 C) 80 D) 81 E) 85

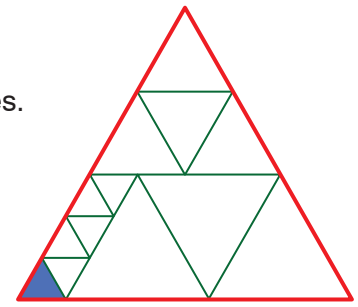
**23.** [Number Theory, 5 Points]

Which of the following numbers is **not** divisible by 5 for any integer n?

A) $n^2 - 1$ B) $2n + 1$ C) $n \cdot (n + 1)$ D) $10n + 1$ E) $n^3 - 1$

**26.** [Geometry, 7 Points]

A large red triangle is divided into equilateral triangles as shown in the figure to the right. The side length of the blue shaded triangle is 2 inches. What is the perimeter of the large red triangle?



A) 54 inches B) 51 inches C) 48 inches D) 45 inches E) 42 inches

**27.** [Number Theory, 7 Points]

The number 987654321 is written on a strip of paper. Patel cuts the strip three times and gets four numbers. Then he adds these four numbers.

**9 8 7 6 5 4 3 2 1**

What is the **least** possible sum he can get?

A) 551 B) 549 C) 547 D) 545 E) 543

MATHCON
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# Grade 5 Sample Final eBook Test

**Problem 1.** If $x + 4 = y^2 - 1 = z^2 + 2 = t - 3 = m^2 + 12$, which of the numbers $x, y, z, t$, and $m$ is the greatest?

A) $x$ B) $y$ C) $z$ D) $t$ E) $m$

**Problem 2.** Suppose $a$ and $b$ are integers and $a+b$ is an odd number. Which of the following is always true?

I) $a - 2b$ is even II) $a \cdot b$ is even III) $4a + b$ is even

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

**Problem 3.** How many ways can the letters of the word TRIANGLE be arranged such that the letters ANGLE appear consecutively, and in that order?

A) 6 B) 18 C) 20 D) 24 E) 56

**Problem 4.** What is the area of an isosceles triangle with side lengths 10, 10, and 12?

A) 48 B) 50 C) 60 D) 72 E) 96

**Problem 5.** In an online math practice test, Junaid attempts exactly $\frac{3}{4}$ of the problems and answers $\frac{5}{8}$ of those problems correctly. When he submits the test, he finds that he answered 105 problems correctly. How many math problems were on this test?

A) 220 B) 224 C) 243 D) 248 E) None of the preceding

**Problem 6.** Distinct, nonzero digits $A$, $B$, and $C$ are such that the three-digit numbers $ABC$, $CAB$, and $BCA$ are divisible by 4, 5, and 9, respectively. What is the greatest possible value of $A \times B \times C$?

A) 20 B) 180 C) 200 D) 210 E) 240

**Problem 7.** Set $A = \{-7, -6, -5, -4, -3, -2, -1, 1, 2, 3\}$. What is the probability that product of two randomly selected numbers is positive number?

A) $\frac{1}{15}$ B) $\frac{4}{15}$ C) $\frac{7}{15}$ D) $\frac{8}{15}$ E) $\frac{14}{15}$

**Problem 8.** A rectangular box has integer side lengths in the ratio of $1 : \frac{3}{2} : 2$. Which of the following could be the volume of the box?

A) 136 B) 148 C) 160 D) 192 E) 204

**Problem 9.** If $A = \frac{21}{19} + \frac{11}{29}$, then which of the following equals $\frac{18}{29} - \frac{2}{19}$?

A) $2 - A$ B) $1 - A$ C) $A$ D) $A + 1$ E) $A + 2$

**Problem 10.** The first page number of a book is 1. The sum of page numbers in the book is less than 2020. If there were 1 more page, then the sum of page numbers in the book would be more than 2020. Find the number of pages of the book.

A) 59 B) 60 C) 61 D) 62 E) 63

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# Grade 5 Sample Final eBook Test Solutions

1.

**Solution.** As $y^2 - 1 = z^2 + 2 = m^2 + 12$, the greatest value among $y^2$, $z^2$ and $m^2$ is $y^2$. On the other hand, as $x + 4 = t - 3$, the greatest value among $x$ and $t$ is $t$. Thus, when we compare $t$ and $y^2$ by using $t - 3 = y^2 - 1$, we have $t = y^2 + 2$. That is, $t$ is the greatest among all of them. The answer is $\boxed{D}$. □

2.

**Solution.** Since $a + b$ is an odd number then $a$ and $b$ both cannot be odd or even at the same time. This lead us to decide $a \cdot b$ is always an even number since odd time even gives us always an even number.The other two options, I and III, don't always create an even number. The answer is $\boxed{B}$. □

3.

**Solution.** We consider ANGLE as a one piece. Then there are 4 pieces to arrange. Therefore there are $4! = 24$ ways. The answer is $\boxed{D}$. □

4.

**Solution.** Using Heron's area formula for triangles, the area of the triangle with sides 10, 10 and 12 is

$$\sqrt{16 \cdot (16-10) \cdot (16-10) \cdot (16-12)} = \sqrt{16 \cdot 6 \cdot 6 \cdot 4} = 48.$$

The answer is $\boxed{A}$. □

5.

**Solution.** Letting $N$ be the number of problems in the test, Junaid attemps $\frac{3N}{4}$ problems where $\frac{5}{8} \cdot \frac{3N}{4} = \frac{15N}{32}$ of them are correct. Since he answered 105 problems correctly, i.e. $105 = \frac{15N}{32}$, we have $N = 224$. The answer is $\boxed{B}$. □

6.

**Solution.** Since $CAB$ is divisible by 5, the value of $B$ is either 0 or 5. However, $BCA$ is a three digit number, therefore $B = 5$. On the other hand, since $ABC$ is divisible by 4, the value of $BC$ is either 52 or 56. Finally, since $BCA$ is divisible by 9, the value of $A$ is either 2 or 7. Therefore, the greatest value of $A \cdot B \cdot C$ is $7 \cdot 5 \cdot 6 = 210$. The answer is $\boxed{D}$. □

7.

**Solution.** One can choose two random numbers from $A$ in $C(10,2) = 45$ ways. Their product is positive when both of the numbers are positive or negative at the same time. That is, there are $C(7,2) + C(3,2) = 21 + 3 = 24$ such choices. Thus, the probability is $\frac{24}{45} = \frac{8}{15}$. The answer is $\boxed{D}$. □

8.

**Solution.** The lowest integer ratio corresponding to $1 : \frac{3}{2} : 2$ is $2 : 3 : 4$, i.e. the sides of the box are $2a, 3a$ and $4a$ for some integer $a$. Then the volume of the box is $24a^3$. Hence, it would be $192$ for $a = 2$, while the others are not in the form $24a^3$. The answer is $\boxed{D}$. □

9.

**Solution.**

$$\frac{18}{29} - \frac{2}{19} = \left(1 - \frac{11}{29}\right) - \left(\frac{21}{19} - 1\right) = 2 - \left(\frac{11}{29} + \frac{21}{19}\right) = 2 - A.$$

The answer is $\boxed{A}$. □

10.

**Solution.** Assume $n$ is the last page of the book. Then we have

$$1 + \ldots + n = \frac{n \cdot (n+1)}{2} < 2020 \text{ and } 1 + \ldots + (n+1) = \frac{(n+1) \cdot (n+2)}{2} > 2020.$$

Since $n$ is an integer, we have $n \leq 63$ in the first inequality, and $n + 1 \geq 64$ in the second inequality. Thus $n = 63$. The answer is $\boxed{E}$. □

[Algebra, 3 Points]

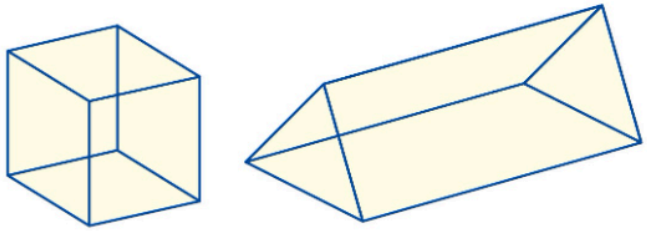
Four parcels, three of which are identical, weigh 5 pounds in total. If the difference between the lighter and the heavier parcel is $\frac{1}{5}$ pound, then what is the weight of each parcel?

A) $\frac{3}{5}$ lb, $\frac{3}{5}$ lb, $\frac{3}{5}$ lb, $\frac{2}{5}$ lb  B) $\frac{6}{5}$ lb, $\frac{6}{5}$ lb, $\frac{6}{5}$ lb, $\frac{7}{5}$ lb  C) $\frac{4}{5}$ lb, $\frac{4}{5}$ lb, $\frac{4}{5}$ lb, $\frac{8}{5}$ lb

D) $\frac{5}{6}$ lb, $\frac{5}{6}$ lb, $\frac{5}{6}$ lb, $\frac{7}{6}$ lb  E) $\frac{5}{8}$ lb, $\frac{5}{8}$ lb, $\frac{5}{8}$ lb, $\frac{7}{8}$ lb

[Geometry, 3 Points]

How many more vertices does a cube have than a triangular prism?



A) 2  B) 3  C) 4  D) 6  E) 8

[Number Theory, 3 Points]

What four numbers have a common multiple of 1050?

A) 2, 3, 7, 9  B) 2, 3, 7, 25  C) 2, 5, 7, 9  D) 2, 3, 5, 12  E) 2, 5, 9, 11

[Combinatorics, 3 Points]

Cameron forms three-digit numbers using the following digits only once.
What is the multiplication of the greatest and the smallest numbers he can make?

A) 144,648  B) 160,146  C) 289,296  D) 214,948  E) 504,288

[Algebra, 5 Points]

Which of the following is equal to $\frac{70}{0.7} + \frac{30}{0.3} + \frac{20}{0.2} + \frac{40}{0.4}$ ?

A) 20  B) 40  C) 200  D) 400  E) 4000

[Geometry, 5 Points]

If the three interior angles of a triangle are 40°, $(x + 5)°$ , and $(2x + 15)°$ then what is the value of x?

A) 40  B) 45  C) 48  D) 50  E) 55

[Number Theory, 5 Points]

Which of the following is **always** a positive number, if

$a < b < 0 < c$?

A) $a + b + c$ B) $a + b - c$ C) $c - a - b$ D) $a \cdot c + b \cdot c$ E) $a \cdot c + c$

[Combinatorics, 5 Points]

Isra has an envelope containing seven 20-cent stamps, three 45-cent stamps and five \$1.00 stamps. She selects one stamp at random. What is the probability that she selects a 20-cent or \$1.00 a stamp?

A) $\frac{1}{3}$ B) $\frac{2}{3}$ C) $\frac{4}{5}$ D) $\frac{5}{6}$ E) None of the preceding

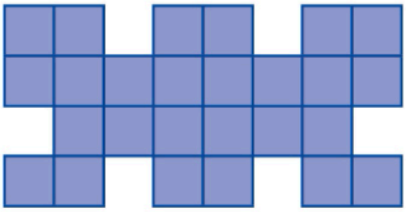
[Algebra, 5 Points]

The average of 3 and 11 is a. The average of a and b is 11. What is the value of b?

A) 11 B) 12 C) 13 D) 14 E) 15

[Geometry, 5 Points]

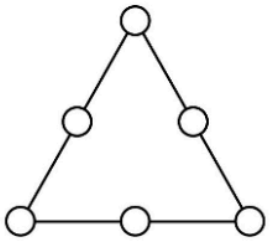
The figure on the right is made from twenty-six identical squares and has a perimeter of 252 cm.
What is the area of the figure?



A) 1274 $cm^2$ B) 1323 $cm^2$ C) 1372 $cm^2$ D) 1421 $cm^2$ E) 1470 $cm^2$

[Number Theory, 5 Points]

The numbers 3, 4, 5, 6, 7, and 8 are written in the magic triangle shown below, such that each number appears exactly once, and the sum of the three numbers on each side is the same. What is the minimum possible value for this sum?



A) 14 B) 15 C) 16 D) 17 E) 18

[Combinatorics, 5 Points]

How many times between 3:59 p.m. and 4:59 p.m. on the same day will all three digits in a digital clock display be even?

A) 10 B) 12 C) 14 D) 15 E) 16

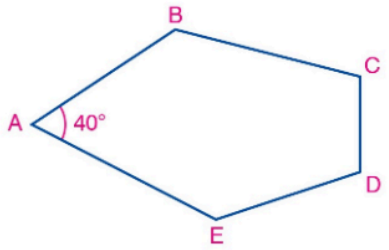
[Algebra, 7 Points]

Five years before Eric was born, Shannon was at the same age Eric is today.
Which of the following **can** be the sum of the ages of Eric and Shannon, three years ago?

A) 30 B) 34 C) 36 D) 40 E) 41

[Geometry, 7 Points]

In pentagon ABCDE, $m\angle A = 40°$, $m\angle B = m\angle E$ and $m\angle C = m\angle D$.




What is the sum of the measures of $\angle B$ and $\angle C$?

A) 225° B) 230° C) 240° D) 250° E) Cannot be determined

[Number Theory, 7 Points]

Which of the following can be the multiplication of three consecutive odd numbers?

A) 747 B) 729 C) 711 D) 693 E) 675

[Combinatorics, 7 Points]

You have one 1-dollar bill, one 5-dollar bill and two 10-dollar bills. How many different face values can you make using these bills?

A) 7 B) 8 C) 9 C) 10 E) 11

[Algebra, 3 Points]

Who am I? I am equal to $\frac{24}{30}$. My numerator is a square number. My denominator is greater than 10. What can be the sum of my numerator and denominator?

A) 9 B) 12 C) 19 D) 27 E) 36

[Geometry, 3 Points]

Points M, N, and K lie on a straight line, and M is not between N and K. The distance from M to N is 20 inches. The distance from K to M is 12 inches. The distance from N to K is

A) 32 inches B) 20 inches C) 8 inches D) 6 inches E) 4 inches

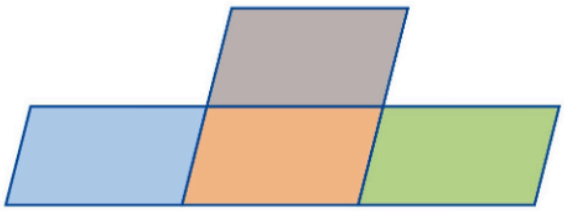
[Number Theory, 3 Points]

Of the following, which is the largest product?

A) $197 \times 203$ B) $198 \times 202$ C) $200 \times 200$ D) $196 \times 204$ E) $195 \times 205$

[Combinatorics, 3 Points]

How many parallelogram of any size are in the figure below?



A) 8 B) 7 C) 6 D) 5 E) 4

[Algebra, 5 Points]

What is the value of $\frac{(0.02)(0.005)}{(0.4)(0.0015)} = ?$

A) $\frac{1}{2}$ B) $\frac{1}{3}$ C) $\frac{1}{4}$ D) $\frac{1}{5}$ E) $\frac{1}{6}$

[Geometry, 5 Points]

How many lines of symmetry does a regular octagon (eight–sided figure) have?

A) 16 B) 8 C) 6 D) 4 E) 2

[Number Theory, 5 Points]

When you divide 30 by a half and then add 10, what number do you get?

A) 25 B) 40 C) 70 D) 75 E) 80

[Combinatorics, 5 Points]

How many integers between 1 and 50 contain the digit "3" at least once?

A) 12 B) 13 C) 14 D) 15 E) 16

[Algebra, 5 Points]

Mr. Johnson arrived at his hotel on November 12 at 4:55 p.m. He left the hotel on November 14 at 11:30 a.m. How long did he stay in the hotel?

A) 40 hours and 15 minutes B) 41 hours and 25 minutes C) 58 hours and 35 minutes
D) 42 hours and 35 minutes E) 52 hours and 15 minutes

[Geometry, 5 Points]

There are six sticks of the following length: 1 cm, 2 cm, 3 cm, 11 cm, 12 cm, and 13 cm on the table.


How many different three-stick selections would make a triangle, when put together as three sides?

A) 1 B) 3 C) 5 D) 6 E) 8

[Number Theory, 5 Points]

What is the smallest possible product of four positive integers whose sum is 2023?

A) 2019 B) 2020 C) 2023 D) 4042 E) 12,102

[Combinatorics, 5 Points]

Tamika picks three numbers by the number picker wheel below.


In how many ways can she get a sum of 28 of these three numbers?

A) 6 B) 7 C) 8 D) 9 E) 10

[Algebra, 7 Points]

Justin's walked two tenths of 0.9 kilometer in the morning, three tenths of 0.6 kilometer in the afternoon, six tenths of 0.3 kilometer in the evening yesterday. Find the total distance did Justin walk?

A) 0.18 kilometers B) 0.054 kilometers C) 54 kilometers
D) 5.4 kilometers E) 0.54 kilometers

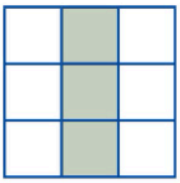
[Geometry, 7 Points]

How many times in two days (= 48 hours) the hour hand and the minute hand of a clock form the right angle with each other?

A) 44 B) 48 C) 66 D) 88 E) 96

[Number Theory, 7 Points]

The figure is a magic square filled with numbers from 1 through 9, one per square. The sum of the integers in each row, column and diagonal is equal. What is the largest possible product of the numbers across the gray column?



A) 45 B) 72 C) 84 D) 96 E) 105

[Combinatorics, 7 Points]

A jar contains 5 blue and 6 green balls. Three balls are withdrawn randomly from the jar consecutively without replacement. What is the probability that the first ball would be blue, the second ball green and the third one blue?

A) $\frac{4}{33}$ B) $\frac{9}{110}$ C) $\frac{12}{55}$ D) $\frac{6}{11}$ E) $\frac{4}{11}$

[Algebra, 3 Points]

What is the mixed number that is equivalent to $\frac{115}{20}$ ?

A) $4\frac{1}{5}$ B) $5\frac{1}{4}$ C) $3\frac{4}{5}$ D) $5\frac{3}{4}$ E) $4\frac{3}{4}$

[Geometry, 3 Points]

Of the choices below, which shape has the most lines of symmetry?

A) a square B) an equilateral triangle C) a scalene triangle
D) a rectangle that is not a square E) a parallelogram that is not a rhombus

[Number Theory, 3 Points]

A box contains more than 100 toys that can be divided equally among 3, 4 or 5 children with no remainder. What is the smallest possible number of toys in the box?

A) 105 B) 108 C) 110 D) 115 E) 120

[Combinatorics, 3 Points]

Out of four of kinds of bicycle and six different helmets, Cameron wants to buy one from each. In how many ways can he make his selection?

A) 10 B) 12 C) 24 D) 30 E) 36

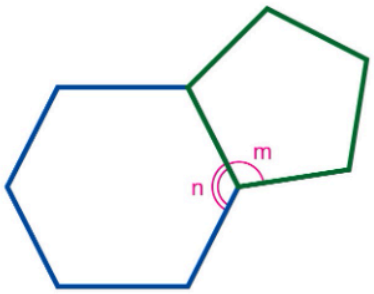
[Algebra, 5 Points]

What is half of $\frac{1}{3}$ , plus a third of $\frac{1}{4}$, plus a quarter of $\frac{1}{5}$?

A) $\frac{1}{30}$ B) $\frac{3}{38}$ C) $\frac{5}{12}$ D) $\frac{1}{3}$ E) $\frac{3}{10}$

[Geometry, 5 Points]

In a plane, a regular pentagon and a regular hexagon share a common side as shown.
What is the sum of the degree measures of angle m and angle n?




A) 248° B) 238° C) 228° D) 218° E) 208°

[Number Theory, 5 Points]

Which of the following is the units digit of the multiplication?

$6 \times 7 \times 8 \times 9 \times 11 \times 12 \times 13 \times 14$

A) 6 B) 5 C) 4 D) 3 E) 2

[Number Theory, 5 Points]

Which of the following is the units digit of the multiplication?

$6 \times 7 \times 8 \times 9 \times 11 \times 12 \times 13 \times 14$

A) 6 B) 5 C) 4 D) 3 E) 2

[Combinatorics, 5 Points]

Makayla will fly to City A and Jordan will fly to City B from the same airport tomorrow. The table below shows the departure times to City A and City B.

| Departure to City A | Departure to City B |
|---|---|
| 10:00 | 13:00 |
| 14:00 | 15:30 |
| 18:00 | 17:00 |
| 22:00 | 21:00 |
| | 23:00 |

How many options do they have if Jordan should fly after Makayla?

A) 12 B) 14 C) 16 D) 18 E) 20

[Algebra, 5 Points]

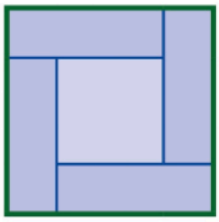
Addition table is given below. What is the identity element?

| + | ☆ | ❖ | ▼ | ★ |
|---|---|---|---|---|
| ☆ | ❖ | ▼ | ★ | ☆ |
| ❖ | ▼ | ★ | ☆ | ❖ |
| ▼ | ★ | ☆ | ❖ | ▼ |
| ★ | ☆ | ❖ | ▼ | ★ |

A) ☆ B) ❖ C) ▼ D) ★ E) There is no identity element.

[Geometry, 5 Points]

The diagram shows four identical rectangles placed inside a green square.
If the perimeter of each rectangle is 24 cm, what is the area of the green square?



A) 72 $cm^2$ B) 81 $cm^2$ C) 100 $cm^2$ D) 121 $cm^2$ E) 144 $cm^2$

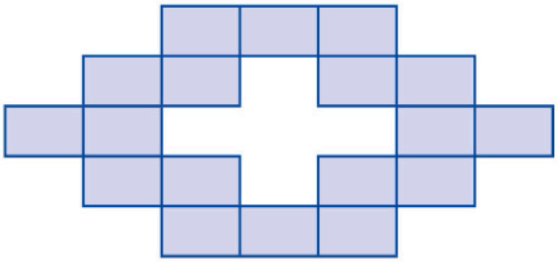
[Number Theory, 5 Points]

What is the sum of distinct three largest two-digit prime numbers?

A) 255 B) 259 C) 265 D) 269 E) 271

[Combinatorics, 5 Points]

How many rectangles of any size are in the figure below?



A) 41 B) 40 C) 39 D) 38 E) 36

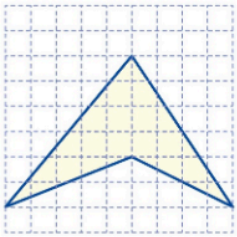
[Algebra, 7 Points]

There is some water in a bottle. For several days back to back, Jane keeps adding as much water as in the previous day. In which day was one-eight of the bottle full, if Jane was able to fill the entire bottle with water at the end of 6th day?

A) 1 B) 2 C) 3 D) 4 E) 5

[Geometry, 7 Points]

What is the ratio of the area of the shaded region to the area of the square grid?



A) 20 : 81 B) 7 : 27 C) 2 : 9 D) 1 : 3 E) 4 : 9

[Number Theory, 7 Points]

Sara has basketball practice every fourth day and swimming practice every seventh day. If she will have her first basketball and swimming practice on September 3, when will be the date on which she has both basketball and swimming practice in November?

A) November 22 B) November 23 C) November 24
D) November 25 E) November 26

[Combinatorics, 7 Points]

How many different 4-digit street addresses can have the digits 3, 3, 6, and 9?
(For example, 3693 or 9633)

A) 12 B) 14 C) 18 D) 22 E) 24

[Algebra, 3 Points]

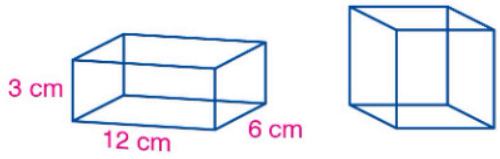
The table below gives the number of animals in Brown's Farm. What is the total number of legs of the animals?

| Animal | Number of Animals |
|---|---|
| Chicken | 15 |
| Cow | 8 |
| Sheep | 12 |
| Duck | 7 |

A) 168 B) 160 C) 152 D) 136 E) 124

[Geometry, 3 Points]

A rectangular prism is 12 cm long, 6 cm wide, and 3 cm high. What is the side length of the cube if the volumes of the cube and the rectangular prism is the same?




A) 4 cm B) 6 cm C) 7 cm D) 8 cm E) 9 cm

[Number Theory, 3 Points]

How many zeros are at the end of

$$10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$$

A) 1 B) 2 C) 3 D) 4 E) 5

[Combinatorics, 3 Points]

Two hardcover books and 2 paperbacks are placed on a shelf. How many ways can the books be arranged if all the hardcover books must be together and all the paperbacks must be together?

A) 2 B) 4 C) 5 D) 6 E) 8

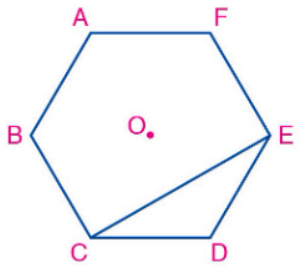
[Algebra, 5 Points]

The average of six dumbbells is 15 pounds. Another 8-pound dumbbell is added to this set. What is the average of the seven dumbbells then?

A) 12 pounds B) 13 pounds C) 14 pounds D) 15 pounds E) 16 pounds

[Geometry, 5 Points]

A diagonal is a line segment joining two vertices of a polygon, when those vertices are not on the same edge. How many diagonals does a regular hexagon have?




A) 9 B) 10 C) 12 D) 13 E) 15

[Number Theory, 5 Points]

Of the following, which is the smallest product?

A) $97 \times 103$ B) $98 \times 102$ C) $100 \times 100$ D) $96 \times 104$ E) $99 \times 101$

[Combinatorics, 5 Points]

What is the maximum possible number of intersection points of a circle, a rectangle, and a triangle, when all three overlap?

A) 14 B) 16 C) 18 D) 20 E) 22

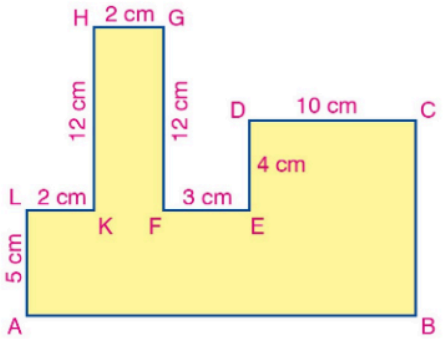
[Algebra, 5 Points]

Multiplying a non-zero number by 0.004 is the same as dividing the number by

A) 25 B) 50 C) 125 D) 250 E) 500

[Geometry, 5 Points]

In the figure, what is the area of the polygon?
(Figure not drawn to scale.)




A) 149 $cm^2$ B) 152 $cm^2$ C) 154 $cm^2$ D) 159 $cm^2$ E) 163 $cm^2$

[Number Theory, 5 Points]

The numbers below follow a pattern.

$$\frac{1}{1000}, \frac{1}{200}, \frac{1}{20}, \frac{3}{4}, 15, \ldots.$$

According to the pattern, which of the following must be the next number?

A) 375 B) 225 C) 125 D) 75 E) $\frac{1}{15}$

[Combinatorics, 5 Points]

How many ordered triplets (group of 3 numbers) of positive integers add up to 10?
For example, there are three triplets that add up to 4:

$1 + 1 + 2 = 4$ $1 + 2 + 1 = 4$ $2 + 1 + 1 = 4$

A) 15 B) 21 C) 28 D) 36 E) 45

[Algebra, 7 Points]

John is 21 years younger than his dad and John's mom is twice as old as John.
5 years ago, John's age was equal to the $\frac{1}{5}$ times the sum his mother's and father's ages.
How old is John today?

A) 18 B) 20 C) 22 D) 23 E) 24

[Geometry, 7 Points]

An artist wants to paint a picture on a canvas where the length of the canvas is 4 less than twice the width. If the total perimeter of the canvas is 94 inches, what is the length of the canvas?

A) 13 inches B) 17 inches C) 21 inches D) 26 inches E) 30 inches

[Number Theory, 7 Points]

A 12-hour clock loses 8 minutes each day. The clock will first return to the correct time in

A) 96 days B) 90 days C) 72 days D) 45 days E) 36 days

[Combinatorics, 7 Points]

How many straight lines can be formed by joining 6 points of which 3 are collinear (on the same line)?

A) 18 B) 16 C) 15 D) 14 E) 13

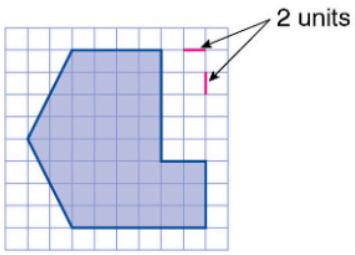
[Algebra, 3 Points]

Which of the following is **not** equal to $2.023 \times 10^5$?

A) $20.23 \times 10^4$ B) $0.2023 \times 10^6$ C) 20230 D) $2023 \times 10^2$ E) $0.002023 \times 10^8$

[Geometry, 3 Points]

What is the area of the figure on grid paper?




A) 194 square units B) 188 square units C) 184 square units
D) 180 square units E) 176 square units

[Number Theory, 3 Points]

What is the sum of the **even** numbers between 91 and 109?

A) 900 B) 920 C) 940 D) 960 E) 1010

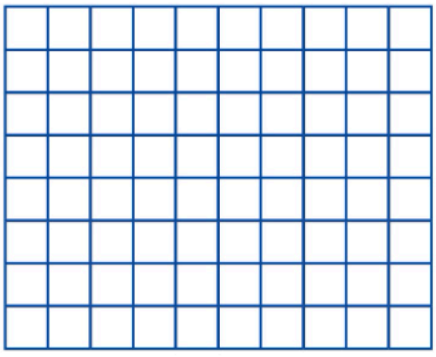
[Combinatorics, 3 Points]

The symbol n! is read as 'n factorial'. For example, $3! = 3 \times 2 \times 1 = 6$, $2! = 2 \times 1 = 2$.
Evaluate: $5! - 4!$

A) 24 B) 72 C) 80 D) 96 E) 104

[Algebra, 5 Points]

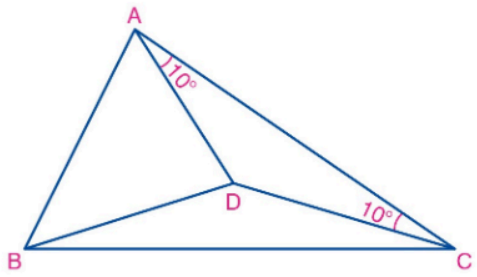
An $8 \times 10$ rectangle is made of $1 \times 1$ squares. How many squares must be shaded to represent 0.725 of the area of the whole rectangle?



A) 56 B) 57 C) 58 D) 59 E) 60

[Geometry, 5 Points]

In the figure below,




ABC is a triangle,
ABD is an equilateral triangle, and
$m\angle DCA = m\angle DAC = 10°$.

What is the measure of the angle ABC?

A) 70° B) 80° C) 85° D) 90° E) 100°

[Number Theory, 5 Points]

If

$$\frac{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot 9 \cdot 10 \cdot 11 \cdot 12}{2^n} = K$$

and K is a whole number, then what is the greatest possible value of n?

A) 10 B) 9 C) 8 D) 7 E) 6

[Combinatorics, 5 Points]

In how many ways can Susan and her four friends line up at the school canteen if Susan should be in the middle of the line?

A) 6 B) 12 C) 18 D) 24 E) 36

[Algebra, 5 Points]

Which of the following might be the sum of five consecutive (back-to-back) odd integers?

A) 280 B) 275 C) 270 D) 267 E) 260

[Geometry, 5 Points]

How many different isosceles triangles have integer side lengths and perimeter 7 cm?

A) 6 B) 5 C) 4 D) 3 E) 2

[Number Theory, 5 Points]

Ruby will erase some of the digits of the number 2034530125 so that the resulting number will be palindromic (*) number. What is the minimum number of digits she needs to erase?

(*) A palindromic number is the same number that is read forward and backwards.
For example 2772 is a palindromic number.

A) 1 B) 2 C) 3 D) 4 E) 5

[Combinatorics, 5 Points]

Kai has two nickels, three dimes, and a quarter.

In how many ways can he choose at most 3 coins, if the order of selection is not important?

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

[Algebra, 7 Points]

a, b, c, and d are integers.

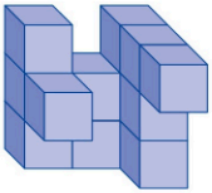
$$(a + b) \cdot (c + d) = 100$$

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

A) 101 B) 52 C) –20 D) –52 E) –101

[Geometry, 7 Points]

What is the surface area of the figure on the right, if each small cube is identical with side lengths 2 cm?



A) 164 $cm^2$ B) 172 $cm^2$ C) 176 $cm^2$ D) 180 $cm^2$ E) 184 $cm^2$

[Number Theory, 7 Points]

In the equation below, the letters A, B and C represent different digits.
What is the greatest value of A?

$$\begin{array}{r} ABC \\ BCA \\ +\ CAB \\ \hline 888 \end{array}$$

A) 9 B) 8 C) 7 D) 6 E) 5

[Combinatorics, 7 Points]

There are 3 novels and 3 comic books on a bookshelf. Janet wants to select and read at least 2 novels and at most 2 comics from the shelf. In how many ways can she select books from the shelf?

A) 21 B) 22 C) 24 D) 27 E) 28

[Algebra, 3 Points]

Each successive week, Luna saves as much money as she does in the previous three weeks. How much will she save in the seventh week, if she saves $25, $30, and $60 in the first three weeks?

A) $1285 B) $700 C) $675 D) $585 E) $380

[Geometry, 3 Points]

How many integer values of x are there so that x cm, 4 cm, and 7 cm could be the side lengths of a triangle?

A) 5 B) 6 C) 7 D) 8 E) 9

[Number Theory, 3 Points]

In a particular year, 25$^{th}$ of August is Thursday. What day is the 5$^{th}$ day of October of the same year?

A) Wednesday B) Thursday C) Friday D) Saturday E) Monday

[Combinatorics, 3 Points]

How many whole numbers less than 100 can be formed using the digits 6, 7, 8 and 9 if a digit **cannot** be used more than once?

A) 12 B) 13 C) 14 D) 15 E) 16

[Algebra, 5 Points]

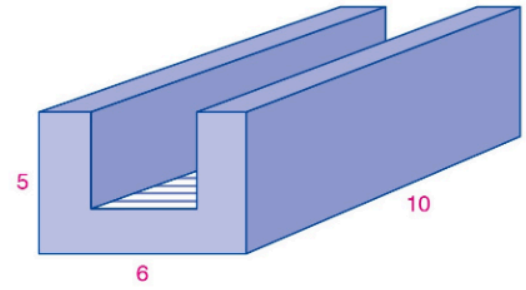
The table below shows the average number of math practice questions students solve per day. If the average number of questions solved by one student in a day is 90, how many students solved 80 questions?

| Average Number of Math Practice Questions | 100 | 150 | 80 | 50 | 200 |
|---|---|---|---|---|---|
| Number of Students | 3 | 2 | X | 8 | 2 |

A) 6 B) 5 C) 4 D) 3 E) 2

[Geometry, 5 Points]

A square prism with base side length 4 cm and height 10 cm is removed from the rectangular prism with side lengths 5 cm, 6 cm, and 10 cm.
What is the volume of the remaining figure?




A) 140 cm$^3$ B) 150 cm$^3$ C) 160 cm$^3$ D) 170 cm$^3$ E) 180 cm$^3$

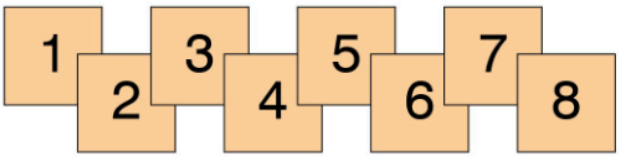
[Number Theory, 5 Points]

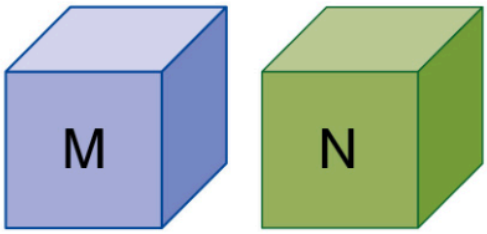
Nora multiplies two-digit number AA by 99 and gets four-digit number ABBA.
What is A + B?

A) 15 B) 13 C) 11 D) 9 E) 7

[Combinatorics, 5 Points]

Eight cards numbered 1 to 8 are put into two boxes M and N so that the sum of the cards in box M is twice the sum of the cards in box N.




If there are exactly 3 cards in box N, then which of the following statements is definitely true?

A) Three cards in box N are odd numbers.

B) Three cards in box N are even numbers.

C) The card numbered 2 is not in box N.

D) The card numbered 6 is in box N.

E) Any three of those 8 numbers can be in box N.

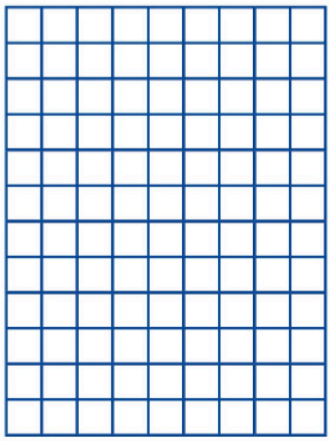
[Algebra, 5 Points]

What is the value of $\frac{(0.02)\cdot(0.005)}{(0.4)\cdot(0.0015)}$ ?

A) $\frac{1}{2}$ B) $\frac{1}{3}$ C) $\frac{1}{4}$ D) $\frac{1}{5}$ E) $\frac{1}{6}$

[Geometry, 5 Points]

Bob is putting a low fence around all four sides of a rectangular garden. The garden is 27 feet wide and 36 feet long.



Each section of fencing is 3 feet long. How many sections of fencing will Bob need?

A) 28 sections B) 32 sections C) 36 sections D) 42 sections E) 46 sections

[Number Theory, 5 Points]

abc, bca, cab are all three-digit numbers. If

$500 < abc < 600$

$200 < bca < 300$

$300 < cab < 400$

then which of the following four-digit numbers is the largest?

A) 4abc B) ab09 C) bc17 D) ca90 E) acb5

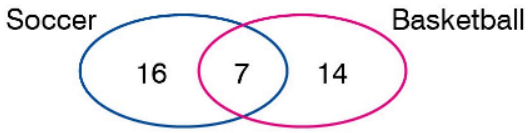
[Combinatorics, 5 Points]

In how many ways can identical 3 red and 2 blue marbles be placed in a row?

A) 10 B) 12 C) 14 D) 15 E) 16

[Algebra, 7 Points]

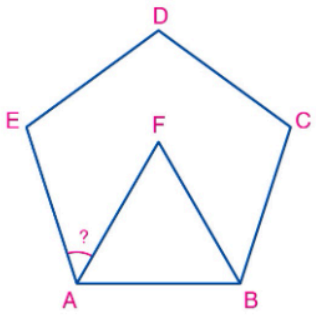
The Venn diagram below shows the number of students who play soccer and basketball.
How many students play basketball **but not** soccer?




A) 30 B) 21 C) 16 D) 14 E) 7

[Geometry, 7 Points]

In the figure on the right, ABCDE is a regular pentagon and ABF is an equilateral triangle.
What is the measure of the angle EAF?




A) 58° B) 56° C) 52° D) 48° E) 46°

[Number Theory, 7 Points]

When the three-digit number **a0b** is divided by the two-digit number **a0**, we have

Divisor + Quotient + Remainder = 85

$$\begin{array}{r} \text{quotient} \\ \text{divisor}\,\overline{)\,\text{divident}} \\ -\,\underline{\qquad\qquad} \\ \text{remainder} \end{array}$$

What is the value of a × b?

A) 35 B) 28 C) 20 D) 18 E) 15

[Combinatorics, 7 Points]

Which of the following can be the six-digit code, from right to left, if the sum of the digits in the even numbered positions is equal to the sum of digits in the odd numbered positions?

A) 71□□92 B) 6□728□ C) 3□4151 D) 19□8□2 E) 293□3□

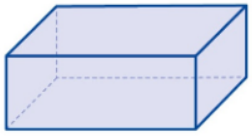
[Algebra, 3 Points]

Yesterday, $\frac{3}{8}$ of 144 students in a contest gave their speeches. Today, half of the rest of the students in the contest gave their speeches. How many students **did not** give their speeches yet?

A) 46 B) 45 C) 44 D) 43 E) 42

[Geometry, 3 Points]

What is the sum of the numbers of faces, vertices, and edges of a rectangular prism?



A) 22 B) 24 C) 26 D) 28 E) 30

[Number Theory, 3 Points]

What is the sum of all positive divisors of 72?

A) 144 B) 167 C) 173 D) 195 E) 197

[Combinatorics, 3 Points]

A member club is choosing a president, a vice president, and a treasurer. There are four members running for president, two members running for vice president, three members running for treasurer. In how many ways can these three people be chosen?

A) 6 B) 12 C) 18 D) 24 E) 36

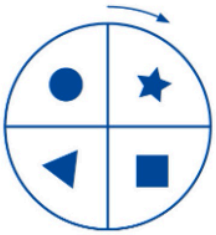
[Algebra, 5 Points]

The difference between two numbers is 629. If the minuend is reduced by 90, and the subtrahend is reduced by x, the new difference will be 547. What is x?

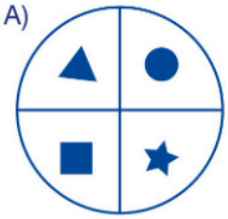
A) 9 B) 8 C) 7 D) 6 E) 5

[Geometry, 5 Points]

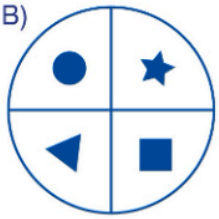
Which of the following will be the final view of the figure on the right, if it is rotated 270° clockwise?



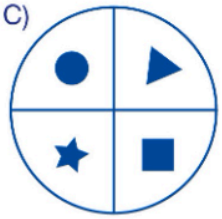
A)



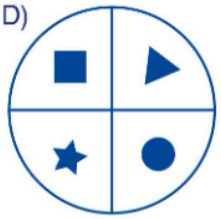
B)



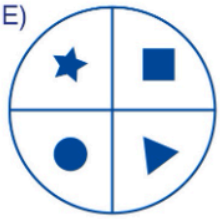
C)



D)

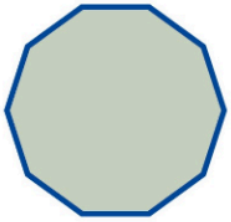


E)



[Geometry, 5 Points]

How many triangles can be obtained when we joined one of the vertices of a 10-sided polygon with each of its vertices?



A) 6 B) 7 C) 8 D) 9 E) 10

[Combinatorics, 5 Points]

There are 7 fruit pieces of different kinds on a tray. How many selections of 3 pieces of fruit can Helen make if she **must** select the apple?

A) 35 B) 32 C) 24 D) 18 E) 15

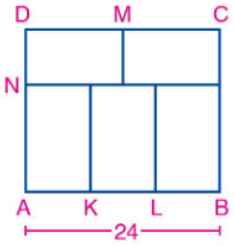
[Algebra, 5 Points]

The sum of three numbers is 135. The third number is twice the second and the first number is 5 less than the second. What is the first number?

A) 70 B) 45 C) 40 D) 35 E) 30

[Geometry, 5 Points]

ABCD is a big rectangle that is made up of 5 small identical rectangles. If the length of side AB is 24 cm, what is the length of BC?




A) 12 cm B) 16 cm C) 18 cm D) 20 cm E) 22 cm

[Number Theory, 5 Points]

5 distinct three-digit numbers are added. Which of the following is the **greatest** possible sum of these 5 numbers?

A) 4985 B) 4987 C) 4990 D) 4993 E) 4995

[Combinatorics, 5 Points]

How many "4 heads and 4 tails" outcomes are possible if a coin is flipped 8 times?

A) 70 B) 56 C) 35 D) 28 E) 21

[Algebra, 7 Points]

When Abigail cuts off $\frac{1}{6}$ of a straight wire, she notices that the midpoint of the wire moves 2 cm away. What was the length of the wire at the beginning?

A) 12 cm B) 18 cm C) 24 cm D) 28 cm E) 30 cm

[Number Theory, 7 Points]

The operation is the multiplication of three-digit number ABC by 42 where each point represents a digit.
What is the product?

$$\begin{array}{r} ABC \\ \times \quad 42 \\ \hline \cdots \\ +\ 8640 \\ \hline \cdots\cdot \end{array}$$

A) 8974 B) 9072 C) 9164 D) 9254 E) 9382

[Number Theory, 7 Points]

AB and BA are two-digit numbers. Which of the following **cannot** be equal to AB – BA?

A) 9 B) 18 C) 36 D) 54 E) 81

. [Combinatorics, 7 Points]

In how many ways can a family with three children be seated at a round table if the mother and father sit together?

A) 10 B) 12 C) 18 D) 24 E) 48

[Algebra, 3 Points]

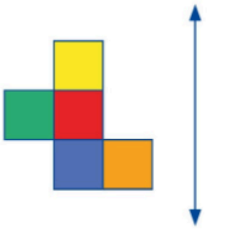
Evaluate the expression.

$$\frac{3}{1-\frac{1}{4}} - \frac{5}{2-\frac{1}{3}}$$

A) 1 B) $\frac{1}{2}$ C) $\frac{1}{3}$ D) $\frac{3}{2}$ E) $\frac{1}{5}$

[Geometry, 3 Points]

Which of the following figures is the reflection of the shape around the vertical line given?



A) 

B) 

C) 

D) 

E) 

[Number Theory, 3 Points]

a and b are positive integers.

$$\frac{a}{4} + b = 8$$

What is the **greatest** possible value of a?

A) 16 B) 20 C) 24 D) 28 E) 32

[Combinatorics, 3 Points]

How many four-letter words can be formed by arranging the letters of the word ERIC if R and I must be next to each other?


A) 6 B) 9 C) 10 D) 12 E) 18

[Algebra, 5 Points]

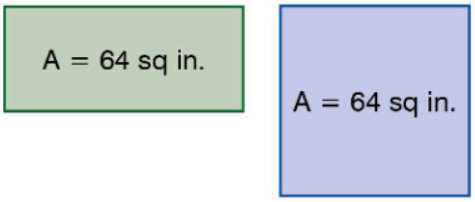
What is the value of the expression?

$$12 \div 2 + 3 \cdot (7 + 3 - 3 \cdot 3) - (7 - 2 \cdot 3)^2$$

A) 7 B) 8 C) 9 D) 10 E) 12

[Geometry, 5 Points]

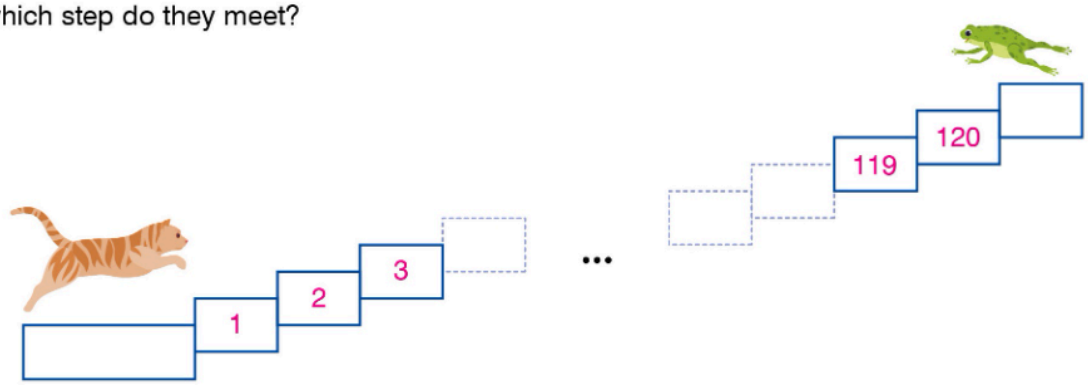
A rectangle and a square both have the same area of 64 sq in. Which of the following can be the sum of their perimeters if the side lengths of both rectangle and square are whole numbers?




A) 72 cm B) 74 cm C) 76 cm D) 78 cm E) 80 cm

[Number Theory, 5 Points]

Every time the cat jumps up to the right 7 steps, the frog jumps down 3 steps to the left. On which step do they meet?




A) 77 B) 78 C) 81 D) 84 E) 87

[Combinatorics, 5 Points]

Levi has either a bunch of 4 cm and 12 cm long sticks together. With which of the combinations below can he make a square, without breaking or overlapping the sticks?

A) 5 short and 2 long B) 3 short and 3 long C) 6 short
D) 4 short and 2 long E) 6 long

[Algebra, 5 Points]

The sum of four numbers is 80. Isabella subtracts a secret number from each of these four numbers and she gets 19, 6, 15 and 12 as the results. Which one of the following is one of those original four numbers?

A) 22 B) 23 C) 25 D) 27 E) 28

[Geometry, 5 Points]

What are the new coordinates of the point (–7, 3) translated 4 units left and 5 units up?

A) (–3, 8) B) (–3, –2) C) (8, –11) D) (–11, –2) E) (–11, 8)

[Number Theory, 5 Points]

What is the sum of all two-digit numbers having 3 for their unit's digit?

A) 481 B) 479 C) 477 D) 475 E) 473

[Combinatorics, 5 Points]

Owen writes 8 numbers from 1 to 8 on a paper. He colors and adds five of these numbers and gets 19. Which of the following **cannot** be one of the uncolored numbers?

**1 2 3 4 5 6 7 8**

A) 1 B) 2 C) 3 D) 4 E) 5

[Algebra, 7 Points]

What is the value of the expression if m and n are distinct nonzero digits?

$$\frac{mnm.n}{m.n} + \frac{m.n}{0.mn}$$

A) 11 B) 99 C) 101 D) 110 E) 111

[Geometry, 7 Points]

How many lines do 7 points determine if three of the points are collinear?

A) 23 B) 22 C) 21 D) 20 E) 19

[Number Theory, 7 Points]

MathCON boot-camp hosts teams with either 6 or 8 members.
How many teams can MathCON host at most, if there are 92 students attending?

A) 16 B) 15 C) 14 D) 13 E) 12

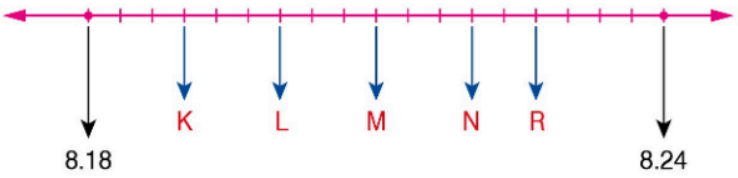
[Combinatorics, 7 Points]

Jerry tosses a coin successively 6 times. In how many ways can Jerry get 3 heads and 3 tails?

A) 18 B) 20 C) 24 D) 30 E) 32

[Algebra, 3 Points]

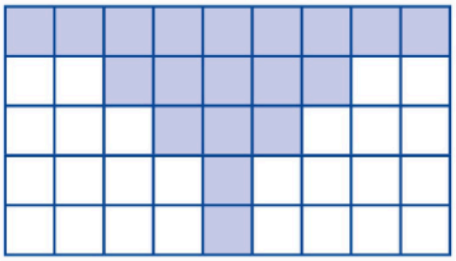
The number line below is divided into equal parts.
Which statement is **false**?




A) K = 8.19 B) L = 8.20 C) M = 8.21 D) N = 8.22 E) R = 8.23

[Geometry, 3 Points]

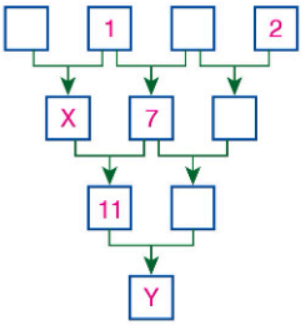
Susan's bathroom wall is covered with blue and white square tiles, as shown on the right. Each tile is 900 $cm^2$. What is the area of the blue region?



A) 17,100 $cm^2$ B) 16,200 $cm^2$ C) 15,300 $cm^2$ D) 14,400 $cm^2$ E) 13,500 $cm^2$

[Number Theory, 3 Points]

In the figure below, each number in a box is the sum of the two boxes above it.




What is the sum X + Y?

A) 21 B) 23 C) 25 D) 28 E) 30

[Combinatorics, 3 Points]

At a business seminar there are six representatives, and each person shakes hands with every other person. How many handshakes are there?

A) 12 B) 15 C) 20 D) 24 E) 30

[Algebra, 5 Points]

Alex makes decimal numbers using each digit 1, 2, and 9 exactly once. If the whole number part of these decimal numbers always have two digits, then what is the sum of all possible decimal numbers?

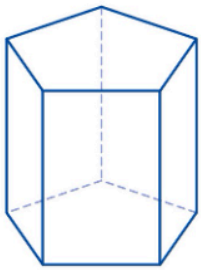
A) 262.4 B) 263.6 C) 264.8 D) 265.6 E) 266.4

[Geometry, 5 Points]

In the given figure:

- the number of faces is, "a"
- the number of edges is, "b"
- the number of vertices is, "c"

What is the value of $a \cdot b - c$?



A) 53 B) 55 C) 75 D) 83 E) 95

[Number Theory, 5 Points]

A tree seedling is growing 17 cm per year. What was the height of it at the end of 4th year, if its height was 181 cm at the end of 8th year?

A) 249 cm B) 232 cm C) 130 cm D) 113 cm E) 96 cm

[Combinatorics, 5 Points]

Lisa wants to get Figure 2 from Figure 1 by cutting it into pieces.

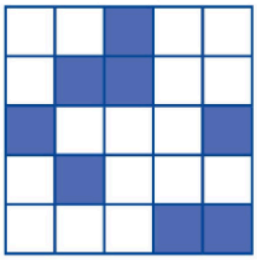


Figure 1

Figure 2

**At most** how many Figure 2 can she have?

A) 4 B) 5 C) 6 D) 7 E) 8

[Algebra, 5 Points]

$\frac{A}{13}$ is a proper and $\frac{25}{B}$ is an improper fraction, then what is the greatest value of $A + B$?

A) 36 B) 39 C) 40 D) 41 E) 42

[Geometry, 5 Points]

- A _____ is a polygon with six sides.
- The longest side of a right triangle is the _____ .
- The legs of an _____ trapezoid have the same length.

Which of the following make the above statements true, respectively?

A) hexagon, perimeter, isosceles
B) pentagon, hypotenuse, isosceles
C) hexagon, hypotenuse, equilateral
D) pentagon, hypotenuse, equilateral
E) hexagon, hypotenuse, isosceles

[Number Theory, 5 Points]

For distinct positive integers a, b, and c

$$a + b = \frac{21}{c}$$

Which of the following expression's result is **always** even?

A) $a \cdot b + c$ B) $a + b \cdot c$ C) $a \cdot c + b$ D) $a \cdot c \cdot b$ E) $a \cdot c + b \cdot c$

[Combinatorics, 5 Points]

Three-digit numbers, with all digits different are formed using 1, 2, 3, 4, or 5.
In how many of these three-digit numbers are 2 on the left of digit 3?

A) 4 B) 5 C) 6 D) 8 E) 9

[Algebra, 7 Points]

Which of the following is equal to the given expression?

$$\frac{0.02 + 0.005}{0.05}$$

A) $\frac{1}{2}$ B) $\frac{1}{5}$ C) $\frac{1}{10}$ D) $\frac{1}{20}$ E) $\frac{1}{40}$

[Geometry, 7 Points]

An apartment building will be constructed inside rectangular shaped land with dimensions 240 yards by 150 yards. The city ordinance requires having a green area around the building with 10 yards width. What is the total area of this green area?

A) 7400 $yd^2$ B) 8200 $yd^2$ C) 14300 $yd^2$ D) 14800 $yd^2$ E) 28600 $yd^2$

[Number Theory, 7 Points]

Evelyn lists all three-digit numbers, where the digit in the middle is greater than the sum of first and last digits. What is the smallest possible sum of such 3 consecutive three-digit numbers?

A) 456 B) 423 C) 393 D) 373 E) 363

[Combinatorics, 7 Points]

Nolan rolled four different colored dice (blue, red, green, and yellow) in the order given and scored a total of 22 points.
How many different orders are possible?

A) 8 B) 9 C) 10 D) 12 E) 15

[Algebra, 3 Points]

Evaluate the given expression.

$$(9.5 + 4.5)^2 - 4 \cdot (9.5) \cdot (4.5)$$

A) 4 B) 9 C) 16 D) 25 E) 36

[Geometry, 3 Points]

Which of the following is formed when a right triangle is rotated about one of its legs?

A) pyramid B) rectangular prism C) cone D) cylinder E) cube

[Number Theory, 3 Points]

There is a relation between the numbers in the first row and the numbers underneath them.

| | | | | | |
|---|---|---|---|---|---|
| 12 | 25 | 42 | A | 88 | 117 |
| 3 | 5 | 7 | 9 | 11 | B |

What is the sum A + B?

A) 72 B) 74 C) 76 D) 78 E) 80

[Combinatorics, 3 Points]

Elijah is using the digits 9, 1, 7 and 0 to make four-digit numbers, using all the digits in each number. What is the difference between the greatest and least possible odd numbers?

A) 10789 B) 10780 C) 8622 D) 7920 E) 7631

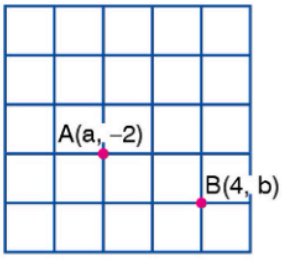
[Algebra, 5 Points]

Robert is 22 years younger than his mother and 25 years younger than his father.
His father will be 67 years old when he will be his mother's present age.
How old is Robert?

A) 19 B) 20 C) 22 D) 24 E) 25

[Geometry, 5 Points]

Given the figure, points A(a, –2) and B(4, b) are in the coordinate plane.
What is the sum a + b?




A) 1 B) 0 C) –1 D) 2 E) 3

[Number Theory, 5 Points]

When 313 is divided by the number x, the quotient is 18 and the remainder is y.
What is the sum x + y?

A) 17 B) 23 C) 24 D) 27 E) 33

[Combinatorics, 5 Points]

Five people, Thomas, Amy, Mark, Debra, and Levi are waiting in the line for a music concert tickets.
In how many ways can they be in the line, if Debra **will not** be next to Amy?

A) 84 B) 72 C) 70 D) 64 E) 48

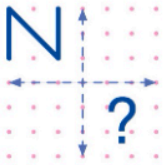
[Algebra, 5 Points]

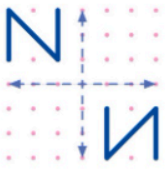
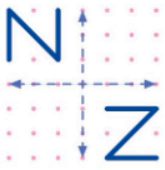
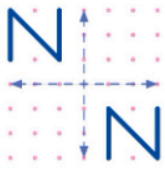
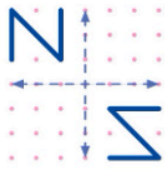
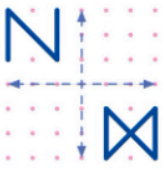
The cost price of an item in a store is the amount the store paid for the item. In a store, the cost price of a sweater is $200 and the cost price of a jacket is $300. The store sells the jacket for 20% more than its cost price and the sweater for 25% less than its cost price.
Which statement is true?

A) The store did not earn or lose any money on the two sales.
B) The store made a $10 profit on the two sales.
C) The store made a $12 profit on the two sales.
D) The store lost $10 on the two sales.
E) The store lost $12 on the two sales.

[Geometry, 5 Points]

Flora reflects the letter N over two lines back to back.
What will the image look like?




A) 
B) 
C) 
D) 
E) 

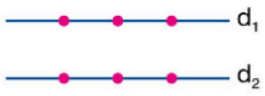
[Number Theory, 5 Points]

The product of the digits a four-digit number is 100.
Which of the following must be one of its digits?

A) 0 B) 1 C) 2 D) 4 E) 5

[Combinatorics, 5 Points]

There are three points on each lines $d_1$ and $d_2$.
How many different triangles can be drawn using any three of these points as vertices?




A) 6 B) 9 C) 12 D) 15 E) 18

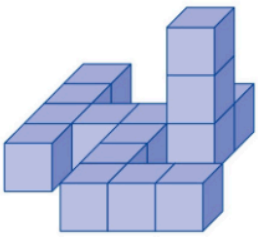
[Algebra, 7 Points]

The difference of two numbers that are equidistant from 5 on the number line is 5.
What is the product of these two numbers?

A) $\frac{75}{2}$ B) $\frac{5}{2}$ C) $\frac{15}{2}$ D) $\frac{75}{4}$ E) $\frac{25}{4}$

[Geometry, 7 Points]

The given figure on the right is composed of identical cubes with side length of 2 cm.
What is the surface area of the figure?



A) 260 $cm^2$ B) 256 $cm^2$ C) 252 $cm^2$ D) 248 $cm^2$ E) 244 $cm^2$

[Number Theory, 7 Points]

$x - y$, $y$, and $x + y$ are three consecutive integers in increasing order.
What is the value of $x \cdot y$?

A) 1 B) 2 C) 3 D) 4 E) 5

[Combinatorics, 7 Points]

Two dice are rolled, and their numbers are multiplied.
How many cases are there that the product is prime?

A) 3 B) 4 C) 5 D) 6 E) 9

[Algebra, 3 Points]

Sum of the ages of John and David is 25. What will be the sum of their ages in 15 years?

A) 40 B) 55 C) 60 D) 70 E) 75

[Geometry, 3 Points]

The height of a rectangular window is three times its width.
If the width of the window is 45 cm, then what is the perimeter?

A) 360 cm B) 320 cm C) 300 cm D) 270 cm E) 240 cm

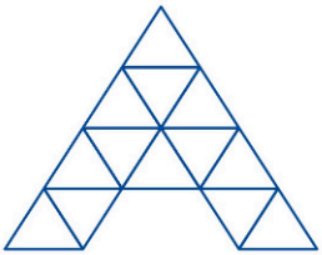
[Number Theory, 3 Points]

What is the sum of the counting numbers from 2010 to 2021? (including 2010 and 2021)?

A) 24,186 B) 24,176 C) 23,186 D) 22,176 E) 22,165

[Combinatorics, 3 Points]

What is the total number of triangles in the following figure?



A) 21 B) 20 C) 19 D) 18 E) 17

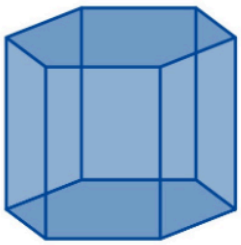
[Algebra, 5 Points]

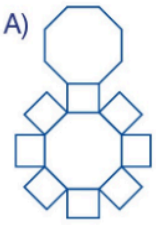
What is one quarter of the number $4^{44}$?

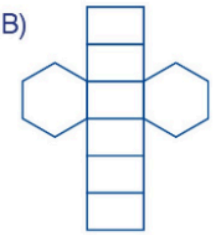
A) $2^{88}$ B) $2^{87}$ C) $2^{86}$ D) $2^{85}$ E) $2^{84}$

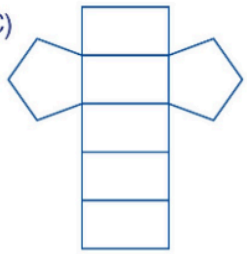
[Geometry, 5 Points]

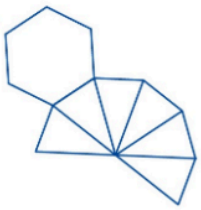
Which of the following is the correct net for the solid shape on the right?

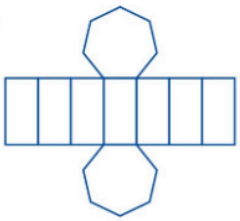


A) 

B) 

C) 

D) 

E) 

[Number Theory, 5 Points]

What is the sum of the terms in the 15th brackets?

(1, 2, 3, 4), (5, 6, 7, 8), (9, 10, 11, 12), ...

A) 250 B) 234 C) 218 D) 202 E) 186

[Combinatorics, 5 Points]

There are five finalists in a long-jump race.
Medals are awarded for first, second and third place.
In how many different ways could the medals be awarded?


A) 120 B) 72 C) 60 D) 48 E) 24

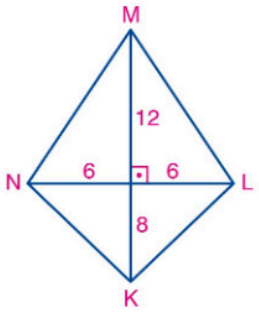
[Algebra, 5 Points]

On the number line, the distances between the number $\frac{5}{4}$ and the numbers $\frac{4}{3}$, $\frac{6}{5}$, and $\frac{7}{6}$ are A, B, and C respectively.
Which of the following is the correct order?

A) $A < B < C$ B) $A = B < C$ C) $B < A < C$ D) $B < A = C$ E) $B < C < A$

. [Geometry, 5 Points]

Figure KLMN is a kite made up of four right triangles as shown.
What is the area of the kite KLMN?




A) 108 square units B) 110 square units C) 112 square units
D) 120 square units E) 144 square units

. [Number Theory, 5 Points]

Composite numbers are positive integers formed by multiplying two smaller positive integers.
The first four composite numbers are 4, 6, 8, and 9.
What is the sum of the first seven composite numbers that are greater than 50?

A) 391 B) 389 C) 387 D) 385 E) 383

[Combinatorics, 5 Points]

There are 500 pages in a book, numbered 1, 2, 3, etc.
How many times does the digit 1 appear in the page numbers?

A) 150 B) 176 C) 180 D) 190 E) 200

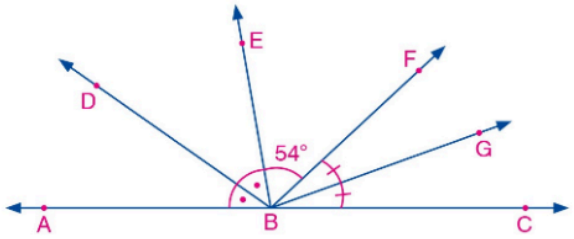
[Algebra, 7 Points]

A fitness center offers membership packages for 1, 2, or 3 months, where 3-month membership includes one month free. So far, 120 membership packages for 215 months (excluding free months) have been sold. Considering 24 months free membership gift, how many 1-month membership packages were sold?

A) 60 B) 54 C) 49 D) 47 E) 24

[Geometry, 7 Points]

In the given figure, points A, B, C are colinear.
Ray BD is the angle bisector of angle ABE.
Ray BG is the angle bisector of angle CBF.
The measure of the angle EBF is 54°.
What is the measure of the angle DBG?




A) 116° B) 117° C) 118° D) 124° E) 126°

[Number Theory, 7 Points]

John is a florist. When he ties up roses in a bunch of 3 roses, or 6 roses, or 8 roses each, he ends up being 2 roses short.
Which of the following is the **minimum** number of roses he will have, if he has more than 150 roses?

A) 194 roses B) 192 roses C) 190 roses D) 170 roses E) 168 roses

[Combinatorics, 7 Points]

The code box on an electronic alarm is activated by a three digit code using digits 5 through 9.
What is the **maximum** number of attempts needed to cancel the alarm?


A) 125 B) 120 C) 64 D) 60 E) 27

# MathCON 2023 - Week 12 Grade 5 Weekly Practice Test

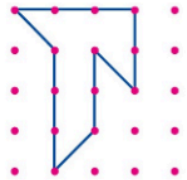
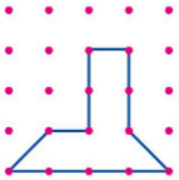
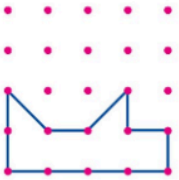
[Algebra, 3 Points]

If 2AA and A27 are three-digit numbers and $\frac{2AA}{A27}$ and $\frac{4}{7}$ are equivalent fractions, then what is A?

A) 2 B) 3 C) 4 D) 5 E) 6

[Geometry, 3 Points]

In which figure is the largest area shown on the dot paper?

A)  B)  C)  D)  E) 

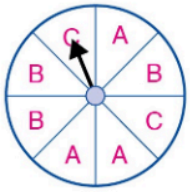
[Number Theory, 3 Points]

Which of the following numbers is the **greatest** prime factor of 690?

A) 69 B) 23 C) 5 D) 3 E) 2

[Combinatorics, 3 Points]

Jasmine will spin the spinner 600 times.
How many times can she expect the spinner to land on A or C?




A) 375 B) 350 C) 325 D) 250 E) 225

[Algebra, 5 Points]

Which of the following describes the rule for the table?

| x | y |
|---|---|
| 1 | 6 |
| 2 | 11 |
| 3 | 16 |
| 4 | 21 |

A) $y = 5x + 3$ B) $y = 3x + 2$ C) $y = 2x + 7$ D) $y = 4x + 2$ E) $y = 5x + 1$

[Geometry, 5 Points]

What is the angle between hour hand and minute hands at 9:10?


A) 130° B) 135° C) 140° D) 142.5° E) 145°

[Number Theory, 5 Points]

In the equation, the letters A and B represent different digits.
What is the value of A + B?

$$\begin{array}{r} 8\ 8\ B \\ 3\ A\ B \\ +\ A\ A\ B \\ \hline 2\ 0\ 4\ A \end{array}$$

A) 13 B) 15 C) 16 D) 17 E) 18

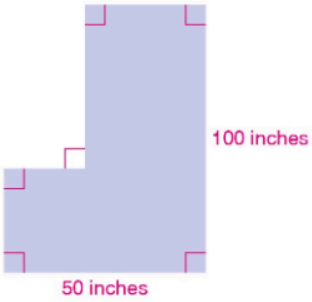
[Algebra, 5 Points]

Dividing a number by 0.8 is equivalent to multiplying the same number by

A) 8 B) 4.5 C) 1.25 D) 0.8 E) 0.125

[Geometry, 5 Points]

What is the perimeter of the figure?




A) 450 inches B) 400 inches C) 350 inches D) 300 inches E) 200 inches

[Number Theory, 5 Points]

Karen has days off on Sundays.
**At most** how many days off can she take in any back to back three months?

A) 11 B) 12 C) 13 D) 14 E) 15

[Combinatorics, 5 Points]

How many rectangles of any size are in the figure?

A) 11 B) 12 C) 13 D) 14 E) 15

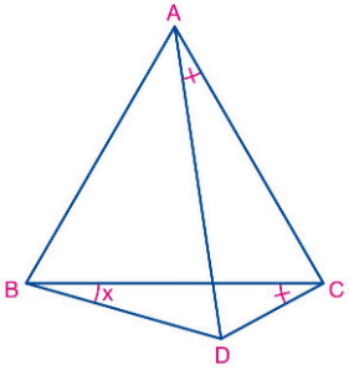
[Algebra, 7 Points]

The average of six different whole numbers is $a + 15$.
If each of these six numbers is decreased by 2 then the new average will be $2a + 4$.
What is the **highest** possible value of the least one of these six numbers at the beginning?

A) 21 B) 22 C) 23 D) 24 E) 25

[Geometry, 7 Points]

In the given figure,
ABC is an equilateral triangle,
AD = AC, and
$m\angle DAC = m\angle DCB$.
What is $m\angle DBC = x$?




A) 5° B) 10° C) 15° D) 20° E) 25°

[Number Theory, 7 Points]

If a, b, and c are whole numbers with

$a < b < c$

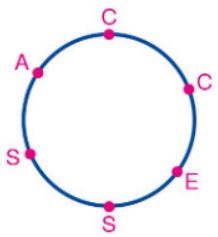
$a \cdot c + b = 11 \cdot a$

then, what is the **greatest** value of $a \cdot b \cdot c$?

A) 90 B) 96 C) 144 D) 288 E) 320

[Combinatorics, 7 Points]

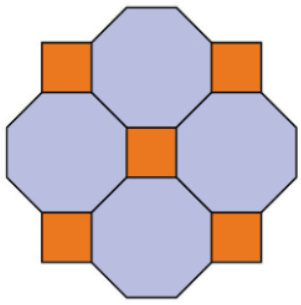
On a circle, how many ways can the letters of the word ACCESS be arranged?




A) 24 B) 30 C) 48 D) 60 E) 120

[Geometry, 3 Points]

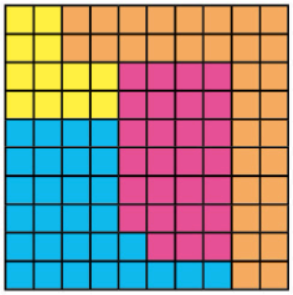
The given figure is made up of regular polygons (squares and octagons). If the perimeter of one square is 21 cm, then what is the perimeter of the whole shape?



A) 100 cm B) 102.5 cm C) 105 cm D) 107.5 cm E) 110 cm

[Algebra, 3 Points]

The big square below is divided into 100 identical small squares and shaded in four different colors.



Which ratio is correct?

A) $\frac{\square}{\square} = \frac{5}{8}$ B) $\frac{\square}{\square} = \frac{15}{14}$ C) $\frac{\square}{\square} = \frac{16}{15}$ D) $\frac{\square}{\square} = \frac{9}{4}$ E) $\frac{\square}{\square} = \frac{2}{5}$

[Number Theory, 3 Points]

The numbers below follow a pattern.

$$144, 24, 4, \frac{2}{3}, \ldots$$

Which of the following must be the next number in the pattern?

A) $\frac{2}{9}$ B) $\frac{1}{9}$ C) $\frac{1}{6}$ D) $\frac{1}{3}$ E) $\frac{1}{2}$

[Combinatorics, 3 Points]

5 people in a meeting room shake hands with each other at the beginning and at the end of the meeting.
What was the total number of handshakes?

A) 20 B) 22 C) 24 D) 26 E) 28

[Algebra, 5 Points]

The average of six weights is 15 grams.
This set of six weights then increased by another weight of 8 grams.
What is the average of the seven weights?

A) 15 grams B) 14 grams C) 13 grams D) 12 grams E) 11 grams

[Geometry, 5 Points]

How many degrees are there in the angle between two hands of a clock at 8:30 pm?


A) 45° B) 60° C) 75° D) 80° E) 90°

[Number Theory, 5 Points]

The factors of 42 are: 1, 2, 3, **A**, 7, **B**, 21, 42.
The factors of 54 are: 1, 2, 3, 6, **C**, **D**, 27, 54.
The factors of 96 are: 1, 2, 3, 4, **E**, 8, 12, 16, 24, **F**, 48, 96.
What is the sum **A** + **B** + **C** + **D** + **E** + **F**?

A) 73 B) 75 C) 85 D) 90 E) 95

[Combinatorics, 5 Points]

Jason forms decimal numbers using each digit 0, 1, 2, 7 and 9 only once.
The whole number parts will have two digits.
What is the difference between the **largest** and the **smallest** decimal numbers Jason can form?

A) 84.139 B) 85.837 C) 86.931 D) 87.319 E) 89.193

[Algebra, 5 Points]

Which of the following is a possible sum of three consecutive even integers?

A) 140 B) 142 C) 144 D) 148 E) 152

. [Geometry, 5 Points]

How many different isosceles triangles have integer side lengths and perimeter 37 cm?

A) 12 B) 11 C) 10 D) 9 E) 8

[Number Theory, 5 Points]

The difference of two numbers is 52, and their quotient is 5 (i.e. when one number is divided by the other, the answer is 5).
What is the sum of two numbers?

A) 54 B) 60 C) 66 D) 72 E) 78

[Combinatorics, 5 Points]

Digits of the decimal number 0.461 are rearranged.
For example, 6.410, 10.64, or 416.0 can be obtained.
How many rearranged decimal numbers are less than 4?

A) 12 B) 10 C) 8 D) 9 E) 6

[Algebra, 7 Points]

If $A = \frac{2}{\frac{5}{3}} - \frac{\frac{2}{5}}{3}$, then which of the following is equal to A?

A) $1\frac{11}{15}$ B) $1\frac{7}{15}$ C) $1\frac{4}{15}$ D) $1\frac{3}{15}$ E) $1\frac{1}{15}$

. [Geometry, 7 Points]

What is the **greatest** number of pieces a circle can be divided into using 5 straight lines?

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

[Number Theory, 7 Points]

Given that, f(A) = Sum of the prime factors of A.
For example, f(60) = 2 + 3 + 5 = 10.
What is the value of f(2022) + f(2023)?

A) 366 B) 364 C) 362 D) 360 E) 358

[Combinatorics, 7 Points]

Ava and Bella ask Camila to choose one of the following numbers.

21, 23, 41, 45, 63

Camila chooses one of the numbers and tells its units digit to Ava and tens digit to Bella.
Then Ava says:

"I could not find the chosen number."

Finally, Bella says:

"I could not find the number first but now I know the chosen number."

What number did Camila chose?

A) 21 B) 23 C) 41 D) 45 E) 63

# MathCON 2023 - Week 14 Grade 5 Weekly Practice Test

[Algebra, 3 Points]

22 more than one-third of a number is equal to four times the number itself.
What is the number?

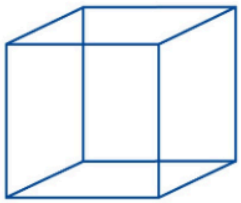
A) 12 B) 9 C) 8 D) 6 E) 3

[Geometry, 3 Points]

A cube has

I. e edges,
II. c corners, and
III. f faces.

Then, what is the value of $e \cdot f \cdot c$?



A) 528 B) 540 C) 552 D) 564 E) 576

[Number Theory, 3 Points]

Which of the following numbers has the **smallest** prime factor?

A) 51 B) 49 C) 35 D) 23 E) 17

[Combinatorics, 3 Points]

How many different combinations of \$1 bills and \$5 bills can be used to make a total of \$33 if the order does not matter?

A) 10 B) 9 C) 8 D) 7 E) 6

[Algebra, 5 Points]

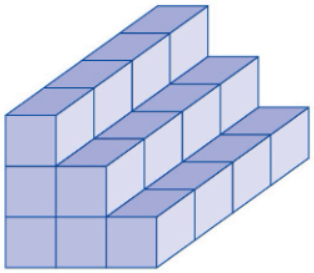
Ella is a clothing salesperson. On Monday, she sold $\frac{2}{5}$ of the blue shirts, and on Tuesday, she sold $\frac{5}{6}$ of the rest of the blue shirts.
What fraction of the shirts remained to be available for sale on Wednesday?

A) $\frac{1}{10}$ B) $\frac{2}{15}$ C) $\frac{1}{6}$ D) $\frac{1}{5}$ E) $\frac{4}{15}$

[Geometry, 5 Points]

A ladder-shaped figure made up of identical cubes shown on the right.

Exactly how many cubes are completely out of your sight?



A) 4 B) 8 C) 9 D) 10 E) 11

[Combinatorics, 5 Points]

The digits 2, 3, and 8 are each used once to form even numbers.

How many numbers can be formed?

A) 14 B) 13 C) 12 D) 11 E) 10

[Algebra, 5 Points]

Which problem situation is represented by the equation: $60 + 3x = 250$?

A) Mark has \$60. He started with \$250. Each of his 3 friends gave him the same amount of money (x). How much money did each friend give Mark?

B) Mark has \$250. He started with \$60. Each of his 3 friends gave him the same amount of money (x). How much money did each friend give Mark?

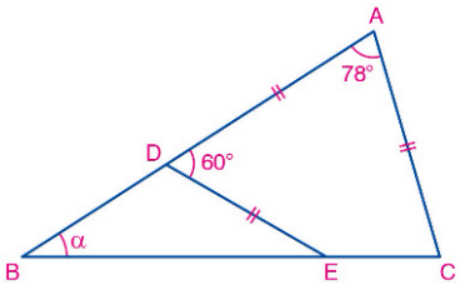
C) Mark has \$60. He gave each of his 3 friends the same amount of money (x). How many friends have \$250?

D) Mark has \$250. He gave each of his 60 friends the same amount of money (x). How much money did Mark give to each friend?

E) Mark has \$250. He gave each of his 3 friends the same amount of money (x). How many friends have \$60?

[Geometry, 5 Points]

In the given figure,




ABC is a triangle,
AD = AC = DE,
m∠ADE = 60°, and
m∠BAC = 78°.

What is m∠ABC = α?

A) 24° B) 23° C) 22° D) 21° E) 19°

[Number Theory, 5 Points]

A list of whole numbers from 1 to 30 is written on a sheet of paper.
All the multiples of 5 are then struck off from the list.
What is the last digit of the multiplication of the remaining numbers?

A) 8 B) 6 C) 4 D) 3 E) 2

[Combinatorics, 5 Points]

What is the number of three-digit positive integers whose sum of the digits is 5?

A) 15 B) 16 C) 17 D) 19 E) 21

[Algebra, 7 Points]

The value of the 6 in 37.286 is $\frac{a}{b}$ times the value of the 6 in 12.768.
The value of the 2 in 37.286 is $\frac{c}{d}$ times the value of the 2 in 12.768.
The value of the 7 in 37.286 is $\frac{e}{f}$ times the value of the 7 in 12.768.
What is the value of $\frac{e}{f} - \frac{c}{d} - \frac{a}{b}$?

A) $\frac{49}{50}$ B) $\frac{49}{5}$ C) $\frac{99}{10}$ D) $\frac{98}{5}$ E) $\frac{99}{5}$

[Geometry, 7 Points]

Which explanation about rhombuses is **not** correct?

A) All rhombuses are parallelograms, but not all parallelograms are rhombuses.
B) All rhombuses are squares.
C) A rhombus is a quadrilateral with four equal-length sides.
D) Opposite angles of a rhombus are equal.
E) All rhombuses have exactly one pair of parallel sides.

[Number Theory, 7 Points]

x, y, and z are distinct numbers. Exactly one of the following statements is true.

I. y is the biggest number.
II. x is not the biggest number.
III. z is not the smallest number.

Which of the following orders is correct?

A) $x > z > y$ B) $x > y > z$ C) $y > z > x$ D) $y > x > z$ E) $z > x > y$

[Combinatorics, 7 Points]

If a, b, c are three counting numbers, and

$$a \cdot b + c = 6$$

then, how many different ordered triples (a, b, c) are there?

A) 12 B) 10 C) 9 D) 8 E) 6

**Question #1**

[Algebra, 3 Points]

How many ounces do 12 tons of banana weigh given that there are 16 ounces in a pound and 2,000 pounds in a ton?

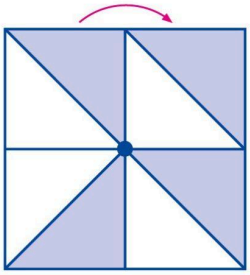
A) 384,000 B) 192,000 C) 3840 D) 24,000 E) 384

**Answer: A**

**Question #2**

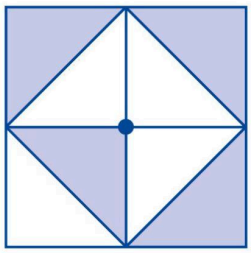
[Geometry, 3 Points]

The square in the figure is rotated clockwise as shown.

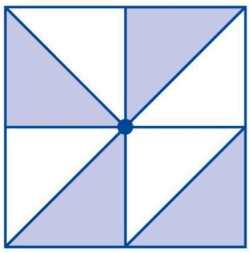


Which of the following figures is possible after the rotation?

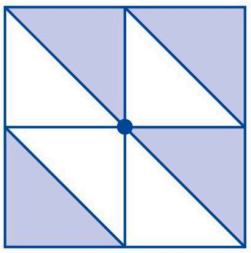
A)



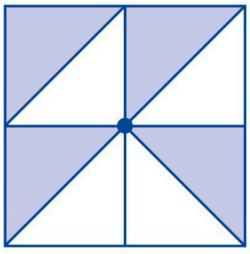
B)



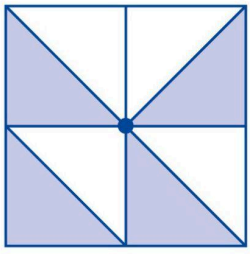
C)



D)



E)



**Answer: D**

**Question #3**

[Number Theory, 3 Points]

What is the value of M, if the four-digit number 26M6 is divisible by 9?

A) 3 B) 4 C) 6 D) 7 E) 8

**Answer: B**

**Question #4**

[Combinatorics, 3 Points]

How many distinct hair styles can be made with four different wigs, and two of three different hair accessories?

A) 24 B) 18 C) 15 D) 14 E) 12

**Answer: E**

**Question #5**

[Algebra, 5 Points]

Which of the following is equal to $\left(\frac{3}{1-\frac{2}{3}}-\frac{3}{2+\frac{1}{4}}\right) \div \frac{23}{9}$ ?

A) 3 B) 4 C) 6 D) 8 E) 9

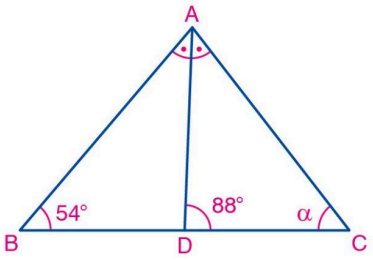
**Answer: A**

## Question #6

[Geometry, 5 Points]

In the given figure,

ABC is a triangle,
AD is the angle bisector,
$m\angle ABC = 54°$, and
$m\angle ADC = 88°$,




then, what is $m\angle ACB = \alpha$?

A) 48° B) 52° C) 54° D) 58° E) 60°

**Answer: D**

## Question #7

[Number Theory, 5 Points]

A perfect square is a number that is the square of an integer.
For example, 1, 4, and 81 are perfect squares, since $1 = 1 \cdot 1$, $4 = 2 \cdot 2$, and $81 = 9 \cdot 9$.
What is the **biggest** four-digit perfect square?

A) 9972 B) 9889 C) 9801 D) 9604 E) 9409

**Answer: C**

## Question #8

[Combinatorics, 5 Points]

For the whole numbers x and y, if

$$x + y + x \cdot y = 111$$

then, what is the **least** value of $x + y$?

A) 20 B) 21 C) 30 D) 42 E) 56

**Answer: A**

## Question #9

[Algebra, 5 Points]

If $A = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4}$ and $B = 2 + \frac{1}{2} + \frac{4}{3} + \frac{3}{4}$

then, what is the difference $B - A$?

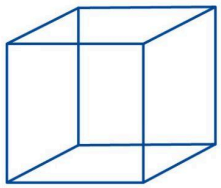
A) 6 B) 4 C) 3 D) 2 E) 1

**Answer: B**

## Question #10

. [Geometry, 5 Points]

Each of 12 edges of a cube is colored either red or green.
Every face of the cube has at least one red edge.
What is the **least** number of red edges?



A) 6 B) 5 C) 4 D) 3 E) 2

**Answer: D**

## Question #11

. [Number Theory, 5 Points]

Which of the following can be the multiplication of three consecutive even numbers?

A) 198 B) 196 C) 194 D) 192 E) 190

**Answer: D**

## Question #12

. [Combinatorics, 5 Points]

For the whole numbers a, b, and c,

$$a + b + c = 4$$

How many different ordered triples (a, b, c) are there?

A) 10 B) 12 C) 13 D) 14 E) 15

**Answer: E**

## Question #13

. [Algebra, 7 Points]

For the whole numbers a, b, and c, if

$$\frac{a}{b} = \frac{1}{3}$$

$$\frac{b}{c} = \frac{2}{7}$$

then, what is the **smallest** value of the sum a + b + c?

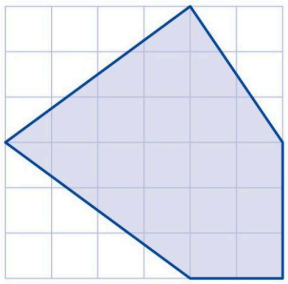
A) 14 B) 17 C) 19 D) 21 E) 29

**Answer: E**

## Question #14

. [Geometry, 7 Points]

The figure is consists of 36 identical squares. What is the ratio of the unshaded region to the shaded region?

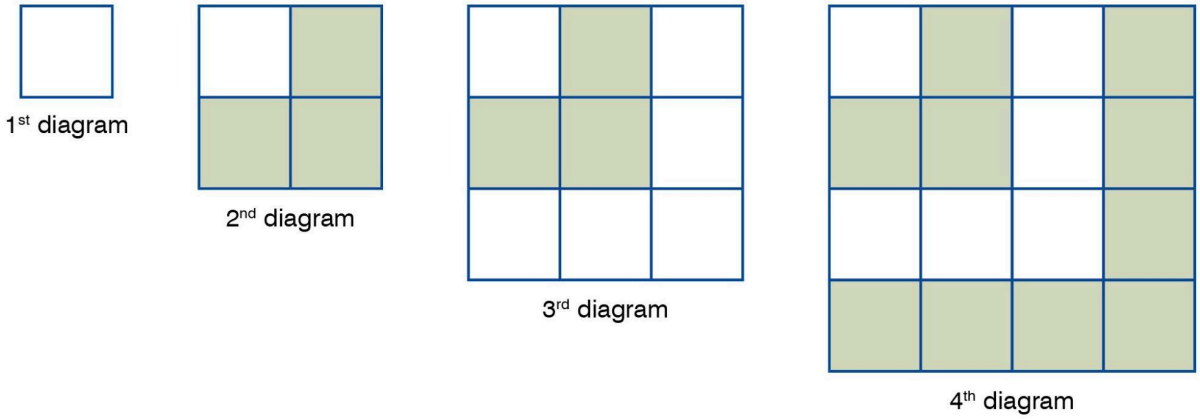


A) $\frac{7}{5}$ B) $\frac{7}{12}$ C) $\frac{5}{7}$ D) $\frac{3}{5}$ E) $\frac{5}{12}$

**Answer: C**

## Question #15

. [Number Theory, 7 Points]




Based on the above pattern, how many more shaded squares than unshaded squares will be in the 50th diagram in the pattern?

A) 200 B) 150 C) 100 D) 75 E) 50

**Answer: E**

## Question #16

. [Combinatorics, 7 Points]

Dr. Aria is on call every six days. If she was on her third call on Wednesday, what day will she be on her 25th call?

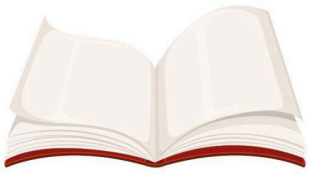
A) Friday B) Thursday C) Wednesday D) Tuesday E) Monday

**Answer: B**

**Question #1**

[Algebra, 3 Points]

Kayla reads $\frac{7}{12}$ of a 240 pages book on Tuesday. She reads $\frac{1}{5}$ of the rest of the book on Wednesday and finished reading the book on Thursday. How many pages did she read on Thursday?



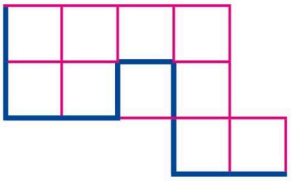
A) 80 B) 75 C) 70 D) 65 E) 60

**Answer: A**

**Question #2**

[Geometry, 3 Points]

The figure shows a board where each small square has an area of 9 $cm^2$. What is the length of the thick blue line?



A) 30 cm B) 33 cm C) 36 cm D) 39 cm E) 42 cm

**Answer: A**

**Question #3**

[Number Theory, 3 Points]

Patricia represented the length of an insect (centimeters) in expanded notation.

$$7 \times 100 + \left(5 \times \frac{1}{100}\right) + \left(3 \times \frac{1}{1{,}000}\right)$$

What is this number in standard form?

A) 70,053 B) 700,53 C) 700,053 D) 7,053 E) 70,53

**Answer: C**

**Question #4**

[Combinatorics, 3 Points]

There are 24 different four-digit positive integers that can be made by arranging the digits 6, 7, 8, 9. When these integers are listed from smallest to largest what is the 7th integer if the first integer is 6789?

A) 7896 B) 7869 C) 7698 D) 7689 E) 6987

**Answer: D**

**Question #5**

[Algebra, 5 Points]

What is the sum of the following numbers

$p + q, \quad q + r, \quad r + s, \quad s + p$

if the mean of p, q, r, and s is 27?

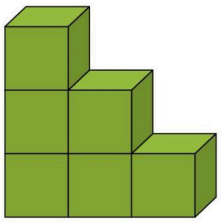
A) 248 B) 240 C) 232 D) 224 E) 216

**Answer: E**

**Question #6**

[Geometry, 5 Points]

Kevin built stairs that are 3 cubes tall.
How many **more** cubes does he need to make the stairs 12 cubes high?



A) 72 B) 68 C) 65 D) 62 E) 58

**Answer: A**

**Question #7**

[Number Theory, 5 Points]

How many two-digit positive integers have **exactly** one 7 as a digit?

A) 21 B) 20 C) 19 D) 18 E) 17

**Answer: E**

**Question #8**

[Combinatorics, 5 Points]

In Linda's garden each plant has either "2 leaves and 1 flower" or "3 leaves". In total, the plants have 18 leaves.
How many different numbers of plants are possible?

A) 7 B) 6 C) 5 D) 4 E) 3

**Answer: D**

**Question #9**

[Algebra, 5 Points]

What is the exact point at $\frac{3}{4}$ of the distance from $1\frac{1}{3}$ to $1\frac{3}{4}$?

A) $\frac{19}{12}$ B) $\frac{35}{24}$ C) $\frac{79}{48}$ D) $\frac{37}{24}$ E) $\frac{61}{48}$

**Answer: C**

**Question #10**

. [Geometry, 5 Points]

The vertices of a triangle are (1, 1), (5, 4), and (3, 4).
What is the area of the triangle?

A) $\frac{3}{2}$ B) $\frac{5}{2}$ C) $\frac{7}{2}$ D) 3 E) 1

**Answer: D**

**Question #11**

. [Number Theory, 5 Points]

If ACB and BCA are three-digit numbers and

$$A - B = 5$$

then, what is ACB – BCA?

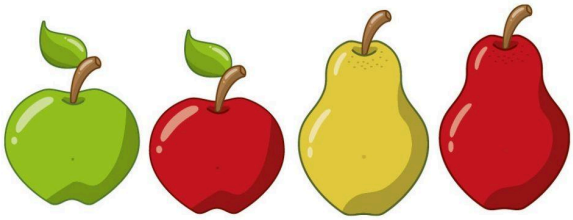
A) 505 B) 495 C) 485 D) 475 E) 465

**Answer: B**

**Question #12**

. [Combinatorics, 5 Points]

In a bag there are 4 green apples, 5 red apples, 8 yellow pears and 3 red pears. Linda randomly takes fruits out of the bag one by one.
How many fruits must she take out in order to be sure that she has **at least** one apple and one pear of the same color?



A) 14 B) 15 C) 17 D) 18 E) 19

**Answer: D**

## Question #13

. [Algebra, 7 Points]

Doctor gives you 5 pills as a cold medicine and tells you to take one pill in every half an hour. How long does it take to finish the pills?

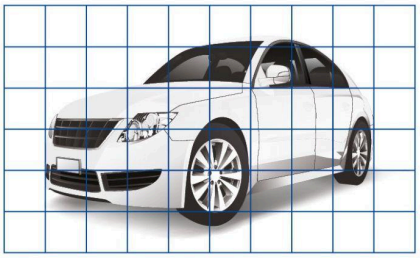
A) $2\frac{1}{2}$ hours B) 2 hours C) $3\frac{1}{2}$ hours D) 3 hours E) $1\frac{1}{2}$ hours

**Answer: B**

## Question #14

. [Geometry, 5 Points]

What is the approximate percent of area of the car printed on the unit square grid?



A) 25% B) 33% C) 45% D) 55% E) 65%

**Answer: C**

## Question #15

. [Number Theory, 7 Points]

How many digits are there in the number $5^9 \times 4^5$?

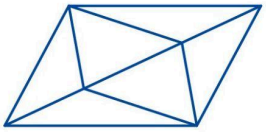
A) 8 B) 9 C) 10 D) 11 E) 12

**Answer: C**

## Question #16

. [Combinatorics, 7 Points]

How many polygons of any size are there in the figure?



A) 33 B) 34 C) 35 D) 36 E) 38

**Answer: B**

**Question#1**

[Algebra, 3 Points]

Four parcels, three of which are identical, weigh 5 pounds in total. If the difference between the lighter and the heavier parcel is $\frac{1}{5}$ pound, then what is the weight of each parcel?

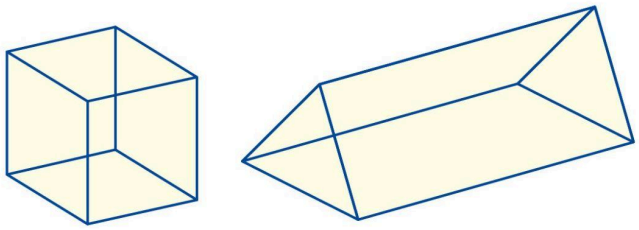
A) $\frac{3}{5}$ lb, $\frac{3}{5}$ lb, $\frac{3}{5}$ lb, $\frac{2}{5}$ lb  B) $\frac{6}{5}$ lb, $\frac{6}{5}$ lb, $\frac{6}{5}$ lb, $\frac{7}{5}$ lb  C) $\frac{4}{5}$ lb, $\frac{4}{5}$ lb, $\frac{4}{5}$ lb, $\frac{8}{5}$ lb

D) $\frac{5}{6}$ lb, $\frac{5}{6}$ lb, $\frac{5}{6}$ lb, $\frac{7}{6}$ lb  E) $\frac{5}{8}$ lb, $\frac{5}{8}$ lb, $\frac{5}{8}$ lb, $\frac{7}{8}$ lb

**Question#2**

[Geometry, 3 Points]

How many more vertices does a cube have than a triangular prism?



A) 2  B) 3  C) 4  D) 6  E) 8

**Question#3**

[Number Theory, 3 Points]

What four numbers have a common multiple of 1050?

A) 2, 3, 7, 9  B) 2, 3, 7, 25  C) 2, 5, 7, 9  D) 2, 3, 5, 12  E) 2, 5, 9, 11

**Question#4**

[Combinatorics, 3 Points]

Cameron forms three-digit numbers using the following digits only once.
What is the multiplication of the greatest and the smallest numbers he can make?

A) 144,648  B) 160,146  C) 289,296  D) 214,948  E) 504,288

**Question#5**

[Algebra, 5 Points]

Which of the following is equal to $\frac{70}{0.7} + \frac{30}{0.3} + \frac{20}{0.2} + \frac{40}{0.4}$ ?

A) 20  B) 40  C) 200  D) 400  E) 4000

**Question#6**

[Geometry, 5 Points]

If the three interior angles of a triangle are $40°$, $(x + 5)°$ , and $(2x + 15)°$ then what is the value of x?

A) 40 B) 45 C) 48 D) 50 E) 55

**Question#7**

[Number Theory, 5 Points]

Which of the following is **always** a positive number, if

$a < b < 0 < c$?

A) $a + b + c$ B) $a + b - c$ C) $c - a - b$ D) $a \cdot c + b \cdot c$ E) $a \cdot c + c$

**Question#8**

[Combinatorics, 5 Points]

Isra has an envelope containing seven 20-cent stamps, three 45-cent stamps and five $1.00 stamps. She selects one stamp at random. What is the probability that she selects a 20-cent or $1.00 a stamp?

A) $\frac{1}{3}$ B) $\frac{2}{3}$ C) $\frac{4}{5}$ D) $\frac{5}{6}$ E) None of the preceding

**Question#9**

[Algebra, 5 Points]

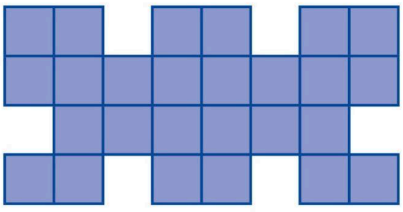
The average of 3 and 11 is a. The average of a and b is 11. What is the value of b?

A) 11 B) 12 C) 13 D) 14 E) 15

**Question#10**

[Geometry, 5 Points]

The figure on the right is made from twenty-six identical squares and has a perimeter of 252 cm.
What is the area of the figure?

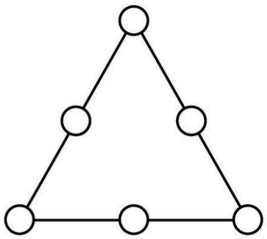


A) 1274 $cm^2$ B) 1323 $cm^2$ C) 1372 $cm^2$ D) 1421 $cm^2$ E) 1470 $cm^2$

**Question#11**

[Number Theory, 5 Points]

The numbers 3, 4, 5, 6, 7, and 8 are written in the magic triangle shown below, such that each number appears exactly once, and the sum of the three numbers on each side is the same. What is the minimum possible value for this sum?



A) 14 B) 15 C) 16 D) 17 E) 18

**Question#12**

[Combinatorics, 5 Points]

How many times between 3:59 p.m. and 4:59 p.m. on the same day will all three digits in a digital clock display be even?

A) 10 B) 12 C) 14 D) 15 E) 16

**Question#13**

[Algebra, 7 Points]

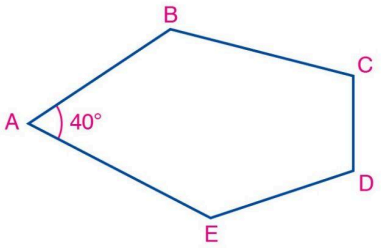
Five years before Eric was born, Shannon was at the same age Eric is today.
Which of the following **can** be the sum of the ages of Eric and Shannon, three years ago?

A) 30 B) 34 C) 36 D) 40 E) 41

**Question#14**

[Geometry, 7 Points]

In pentagon ABCDE, $m\angle A = 40°$, $m\angle B = m\angle E$ and $m\angle C = m\angle D$.




What is the sum of the measures of $\angle B$ and $\angle C$?

A) 225° B) 230° C) 240° D) 250° E) Cannot be determined

**Question#15**

[Number Theory, 7 Points]

Which of the following can be the multiplication of three consecutive odd numbers?

A) 747 B) 729 C) 711 D) 693 E) 675

**Question#16**

[Combinatorics, 7 Points]

You have one 1-dollar bill, one 5-dollar bill and two 10-dollar bills. How many different face values can you make using these bills?

A) 7 B) 8 C) 9 C) 10 E) 11

**Question#1**

[Algebra, 3 Points]

Who am I? I am equal to $\frac{24}{30}$. My numerator is a square number. My denominator is greater than 10. What can be the sum of my numerator and denominator?

A) 9 B) 12 C) 19 D) 27 E) 36

**Question#2**

[Geometry, 3 Points]

Points M, N, and K lie on a straight line, and M is not between N and K. The distance from M to N is 20 inches. The distance from K to M is 12 inches. The distance from N to K is

A) 32 inches B) 20 inches C) 8 inches D) 6 inches E) 4 inches

**Question#3**

[Number Theory, 3 Points]

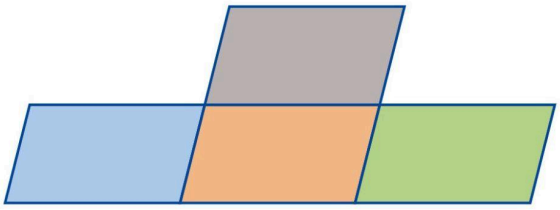
Of the following, which is the largest product?

A) $197 \times 203$ B) $198 \times 202$ C) $200 \times 200$ D) $196 \times 204$ E) $195 \times 205$

**Question#4**

[Combinatorics, 3 Points]

How many parallelogram of any size are in the figure below?



A) 8 B) 7 C) 6 D) 5 E) 4

**Question#5**

[Algebra, 5 Points]

What is the value of $\frac{(0.02)(0.005)}{(0.4)(0.0015)} = ?$

A) $\frac{1}{2}$ B) $\frac{1}{3}$ C) $\frac{1}{4}$ D) $\frac{1}{5}$ E) $\frac{1}{6}$

**Question#6**

[Geometry, 5 Points]

How many lines of symmetry does a regular octagon (eight–sided figure) have?

A) 16 B) 8 C) 6 D) 4 E) 2

**Question#7**

[Number Theory, 5 Points]

When you divide 30 by a half and then add 10, what number do you get?

A) 25 B) 40 C) 70 D) 75 E) 80

**Question#8**

[Combinatorics, 5 Points]

How many integers between 1 and 50 contain the digit "3" at least once?

A) 12 B) 13 C) 14 D) 15 E) 16

**Question#9**

[Algebra, 5 Points]

Mr. Johnson arrived at his hotel on November 12 at 4:55 p.m. He left the hotel on November 14 at 11:30 a.m. How long did he stay in the hotel?

A) 40 hours and 15 minutes B) 41 hours and 25 minutes C) 58 hours and 35 minutes
D) 42 hours and 35 minutes E) 52 hours and 15 minutes

**Question#10**

[Geometry, 5 Points]

There are six sticks of the following length: 1 cm, 2 cm, 3 cm, 11 cm, 12 cm, and 13 cm on the table.


How many different three-stick selections would make a triangle, when put together as three sides?

A) 1 B) 3 C) 5 D) 6 E) 8

**Question#11**

[Number Theory, 5 Points]

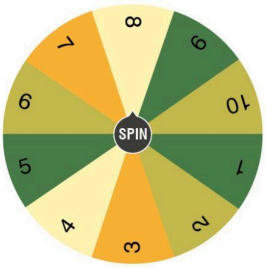
What is the smallest possible product of four positive integers whose sum is 2023?

A) 2019 B) 2020 C) 2023 D) 4042 E) 12,102

**Question#12**

[Combinatorics, 5 Points]

Tamika picks three numbers by the number picker wheel below.




In how many ways can she get a sum of 28 of these three numbers?

A) 6 B) 7 C) 8 D) 9 E) 10

**Question#13**

[Algebra, 7 Points]

Justin's walked two tenths of 0.9 kilometer in the morning, three tenths of 0.6 kilometer in the afternoon, six tenths of 0.3 kilometer in the evening yesterday. Find the total distance did Justin walk?

A) 0.18 kilometers B) 0.054 kilometers C) 54 kilometers
D) 5.4 kilometers E) 0.54 kilometers

**Question#14**

[Geometry, 7 Points]

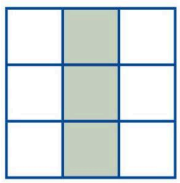
How many times in two days (= 48 hours) the hour hand and the minute hand of a clock form the right angle with each other?

A) 44 B) 48 C) 66 D) 88 E) 96

**Question#15**

[Number Theory, 7 Points]

The figure is a magic square filled with numbers from 1 through 9, one per square. The sum of the integers in each row, column and diagonal is equal. What is the largest possible product of the numbers across the gray column?



A) 45 B) 72 C) 84 D) 96 E) 105

**Question#16**

[Combinatorics, 7 Points]

A jar contains 5 blue and 6 green balls. Three balls are withdrawn randomly from the jar consecutively without replacement. What is the probability that the first ball would be blue, the second ball green and the third one blue?

A) $\frac{4}{33}$ B) $\frac{9}{110}$ C) $\frac{12}{55}$ D) $\frac{6}{11}$ E) $\frac{4}{11}$

**Question#1**

[Algebra, 3 Points]

What is the mixed number that is equivalent to $\frac{115}{20}$ ?

A) $4\frac{1}{5}$ B) $5\frac{1}{4}$ C) $3\frac{4}{5}$ D) $5\frac{3}{4}$ E) $4\frac{3}{4}$

**Question#2**

[Geometry, 3 Points]

Of the choices below, which shape has the most lines of symmetry?

A) a square B) an equilateral triangle C) a scalene triangle

D) a rectangle that is not a square E) a parallelogram that is not a rhombus

**Question#3**

[Number Theory, 3 Points]

A box contains more than 100 toys that can be divided equally among 3, 4 or 5 children with no remainder. What is the smallest possible number of toys in the box?

A) 105 B) 108 C) 110 D) 115 E) 120

**Question#4**

[Combinatorics, 3 Points]

Out of four of kinds of bicycle and six different helmets, Cameron wants to buy one from each. In how many ways can he make his selection?

A) 10 B) 12 C) 24 D) 30 E) 36

**Question#5**

[Algebra, 5 Points]

What is half of $\frac{1}{3}$ , plus a third of $\frac{1}{4}$, plus a quarter of $\frac{1}{5}$?

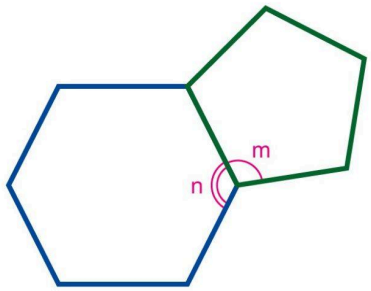
A) $\frac{1}{30}$ B) $\frac{3}{38}$ C) $\frac{5}{12}$ D) $\frac{1}{3}$ E) $\frac{3}{10}$

## Question#6

[Geometry, 5 Points]

In a plane, a regular pentagon and a regular hexagon share a common side as shown.

What is the sum of the degree measures of angle m and angle n?




A) 248° B) 238° C) 228° D) 218° E) 208°

## Question#7

[Number Theory, 5 Points]

Which of the following is the units digit of the multiplication?

$6 \times 7 \times 8 \times 9 \times 11 \times 12 \times 13 \times 14$

A) 6 B) 5 C) 4 D) 3 E) 2

## Question#8

[Combinatorics, 5 Points]

Makayla will fly to City A and Jordan will fly to City B from the same airport tomorrow.

The table below shows the departure times to City A and City B.

| Departure to City A | Departure to City B |
|---|---|
| 10:00 | 13:00 |
| 14:00 | 15:30 |
| 18:00 | 17:00 |
| 22:00 | 21:00 |
| | 23:00 |

How many options do they have if Jordan should fly after Makayla?

A) 12 B) 14 C) 16 D) 18 E) 20

## Question#9

[Algebra, 5 Points]

Addition table is given below. What is the identity element?

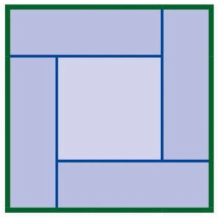
| + | ☆ | ❖ | ▼ | ★ |
|---|---|---|---|---|
| ☆ | ❖ | ▼ | ★ | ☆ |
| ❖ | ▼ | ★ | ☆ | ❖ |
| ▼ | ★ | ☆ | ❖ | ▼ |
| ★ | ☆ | ❖ | ▼ | ★ |

A) ☆ B) ❖ C) ▼ D) ★ E) There is no identity element.

## Question#10

[Geometry, 5 Points]

The diagram shows four identical rectangles placed inside a green square.
If the perimeter of each rectangle is 24 cm, what is the area of the green square?



A) 72 $cm^2$ B) 81 $cm^2$ C) 100 $cm^2$ D) 121 $cm^2$ E) 144 $cm^2$

## Question#11

[Number Theory, 5 Points]

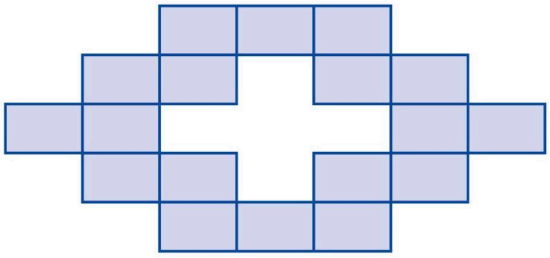
What is the sum of distinct three largest two-digit prime numbers?

A) 255 B) 259 C) 265 D) 269 E) 271

## Question#12

[Combinatorics, 5 Points]

How many rectangles of any size are in the figure below?



A) 41 B) 40 C) 39 D) 38 E) 36

## Question#13

. [Algebra, 7 Points]

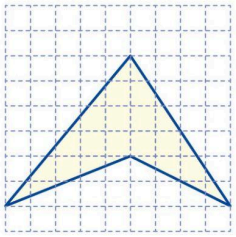
There is some water in a bottle. For several days back to back, Jane keeps adding as much water as in the previous day. In which day was one-eight of the bottle full, if Jane was able to fill the entire bottle with water at the end of 6th day?

A) 1 B) 2 C) 3 D) 4 E) 5

## Question#14

. [Geometry, 7 Points]

What is the ratio of the area of the shaded region to the area of the square grid?



A) 20 : 81 B) 7 : 27 C) 2 : 9 D) 1 : 3 E) 4 : 9

## Question#15

. [Number Theory, 7 Points]

Sara has basketball practice every fourth day and swimming practice every seventh day. If she will have her first basketball and swimming practice on September 3, when will be the date on which she has both basketball and swimming practice in November?

A) November 22 B) November 23 C) November 24
D) November 25 E) November 26

## Question#16

. [Combinatorics, 7 Points]

How many different 4-digit street addresses can have the digits 3, 3, 6, and 9?
(For example, 3693 or 9633)

A) 12 B) 14 C) 18 D) 22 E) 24

## Question#1

[Algebra, 3 Points]

The table below gives the number of animals in Brown's Farm. What is the total number of legs of the animals?

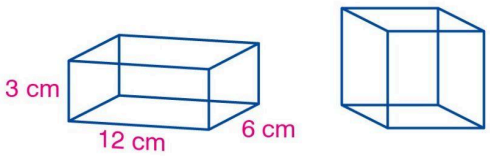
| Animal | Number of Animals |
|---|---|
| Chicken | 15 |
| Cow | 8 |
| Sheep | 12 |
| Duck | 7 |

A) 168 B) 160 C) 152 D) 136 E) 124

## Question#2

[Geometry, 3 Points]

A rectangular prism is 12 cm long, 6 cm wide, and 3 cm high. What is the side length of the cube if the volumes of the cube and the rectangular prism is the same?




A) 4 cm B) 6 cm C) 7 cm D) 8 cm E) 9 cm

## Question#3

[Number Theory, 3 Points]

How many zeros are at the end of

$$10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$$

A) 1 B) 2 C) 3 D) 4 E) 5

## Question#4

[Combinatorics, 3 Points]

Two hardcover books and 2 paperbacks are placed on a shelf. How many ways can the books be arranged if all the hardcover books must be together and all the paperbacks must be together?

A) 2 B) 4 C) 5 D) 6 E) 8

## Question#5

[Algebra, 5 Points]

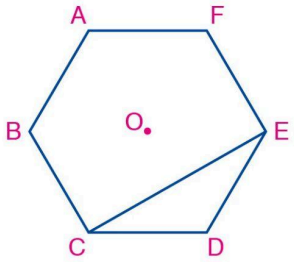
The average of six dumbbells is 15 pounds. Another 8-pound dumbbell is added to this set. What is the average of the seven dumbbells then?

A) 12 pounds B) 13 pounds C) 14 pounds D) 15 pounds E) 16 pounds

## Question#6

[Geometry, 5 Points]

A diagonal is a line segment joining two vertices of a polygon, when those vertices are not on the same edge. How many diagonals does a regular hexagon have?




A) 9 B) 10 C) 12 D) 13 E) 15

## Question#7

[Number Theory, 5 Points]

Of the following, which is the smallest product?

A) $97 \times 103$ B) $98 \times 102$ C) $100 \times 100$ D) $96 \times 104$ E) $99 \times 101$

## Question#8

[Combinatorics, 5 Points]

What is the maximum possible number of intersection points of a circle, a rectangle, and a triangle, when all three overlap?

A) 14 B) 16 C) 18 D) 20 E) 22

## Question#9

[Algebra, 5 Points]

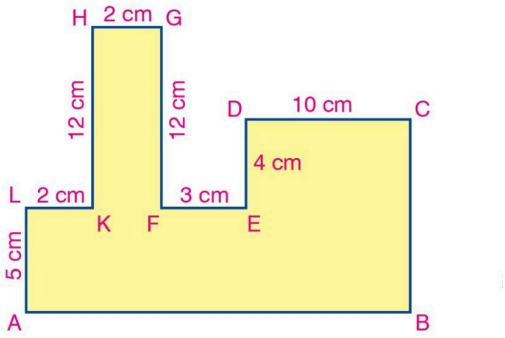
Multiplying a non-zero number by 0.004 is the same as dividing the number by

A) 25 B) 50 C) 125 D) 250 E) 500

## Question#10

. [Geometry, 5 Points]

In the figure, what is the area of the polygon?
(Figure not drawn to scale.)




A) 149 $cm^2$ B) 152 $cm^2$ C) 154 $cm^2$ D) 159 $cm^2$ E) 163 $cm^2$

## Question#11

. [Number Theory, 5 Points]

The numbers below follow a pattern.

$$\frac{1}{1000}, \frac{1}{200}, \frac{1}{20}, \frac{3}{4}, 15, \ldots.$$

According to the pattern, which of the following must be the next number?

A) 375 B) 225 C) 125 D) 75 E) $\frac{1}{15}$

## Question#12

. [Combinatorics, 5 Points]

How many ordered triplets (group of 3 numbers) of positive integers add up to 10?
For example, there are three triplets that add up to 4:

$1 + 1 + 2 = 4$ $1 + 2 + 1 = 4$ $2 + 1 + 1 = 4$

A) 15 B) 21 C) 28 D) 36 E) 45

## Question#13

. [Algebra, 7 Points]

John is 21 years younger than his dad and John's mom is twice as old as John.
5 years ago, John's age was equal to the $\frac{1}{5}$ times the sum his mother's and father's ages.
How old is John today?

A) 18 B) 20 C) 22 D) 23 E) 24

**Question#14**

. [Geometry, 7 Points]

An artist wants to paint a picture on a canvas where the length of the canvas is 4 less than twice the width. If the total perimeter of the canvas is 94 inches, what is the length of the canvas?

A) 13 inches B) 17 inches C) 21 inches D) 26 inches E) 30 inches

**Question#15**

. [Number Theory, 7 Points]

A 12-hour clock loses 8 minutes each day. The clock will first return to the correct time in

A) 96 days B) 90 days C) 72 days D) 45 days E) 36 days

**Question#16**

. [Combinatorics, 7 Points]

How many straight lines can be formed by joining 6 points of which 3 are collinear (on the same line)?

A) 18 B) 16 C) 15 D) 14 E) 13

**Question#1**

[Algebra, 3 Points]

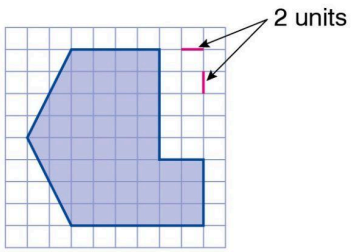
Which of the following is **not** equal to $2.023 \times 10^5$?

A) $20.23 \times 10^4$ B) $0.2023 \times 10^6$ C) 20230 D) $2023 \times 10^2$ E) $0.002023 \times 10^8$

**Question#2**

[Geometry, 3 Points]

What is the area of the figure on grid paper?




A) 194 square units B) 188 square units C) 184 square units

D) 180 square units E) 176 square units

**Question#3**

[Number Theory, 3 Points]

What is the sum of the **even** numbers between 91 and 109?

A) 900 B) 920 C) 940 D) 960 E) 1010

**Question#4**

[Combinatorics, 3 Points]

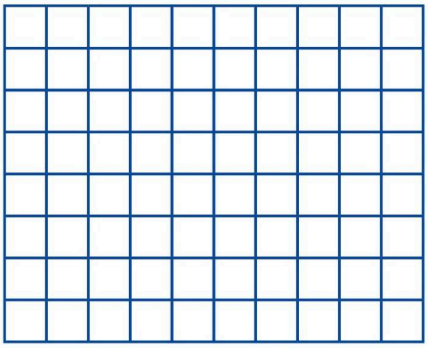
The symbol n! is read as 'n factorial'. For example, $3! = 3 \times 2 \times 1 = 6$, $2! = 2 \times 1 = 2$.
Evaluate: $5! - 4!$

A) 24 B) 72 C) 80 D) 96 E) 104

## Question#5

[Algebra, 5 Points]

An 8 × 10 rectangle is made of 1 × 1 squares. How many squares must be shaded to represent 0.725 of the area of the whole rectangle?

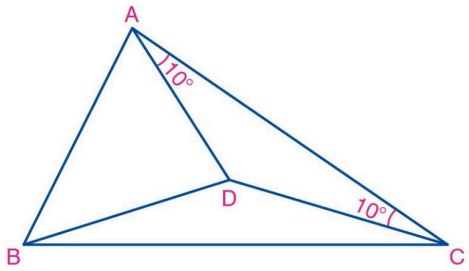


A) 56 B) 57 C) 58 D) 59 E) 60

## Question#6

[Geometry, 5 Points]

In the figure below,




ABC is a triangle,
ABD is an equilateral triangle, and
m∠DCA = m∠DAC = 10°.

What is the measure of the angle ABC?

A) 70° B) 80° C) 85° D) 90° E) 100°

## Question#7

[Number Theory, 5 Points]

If

$$\frac{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot 9 \cdot 10 \cdot 11 \cdot 12}{2^n} = K$$

and K is a whole number, then what is the greatest possible value of n?

A) 10 B) 9 C) 8 D) 7 E) 6

## Question#8

[Combinatorics, 5 Points]

In how many ways can Susan and her four friends line up at the school canteen if Susan should be in the middle of the line?

A) 6 B) 12 C) 18 D) 24 E) 36

## Question#9

[Algebra, 5 Points]

Which of the following might be the sum of five consecutive (back-to-back) odd integers?

A) 280 B) 275 C) 270 D) 267 E) 260

## Question#10

. [Geometry, 5 Points]

How many different isosceles triangles have integer side lengths and perimeter 7 cm?

A) 6 B) 5 C) 4 D) 3 E) 2

## Question#11

. [Number Theory, 5 Points]

Ruby will erase some of the digits of the number 2034530125 so that the resulting number will be palindromic (*) number. What is the minimum number of digits she needs to erase?

(*) A palindromic number is the same number that is read forward and backwards.
For example 2772 is a palindromic number.

A) 1 B) 2 C) 3 D) 4 E) 5

## Question#12

. [Combinatorics, 5 Points]

Kai has two nickels, three dimes, and a quarter.

In how many ways can he choose at most 3 coins, if the order of selection is not important?

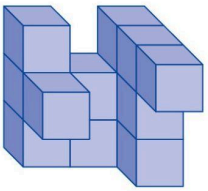
A) 17 B) 16 C) 15 D) 14 E) 13

## Question#13

## Question#14

. [Geometry, 7 Points]

What is the surface area of the figure on the right, if each small cube is identical with side lengths 2 cm?



A) 164 $cm^2$ B) 172 $cm^2$ C) 176 $cm^2$ D) 180 $cm^2$ E) 184 $cm^2$

## Question#15

. [Number Theory, 7 Points]

In the equation below, the letters A, B and C represent different digits.
What is the greatest value of A?

$$\begin{array}{r} ABC \\ BCA \\ +\ CAB \\ \hline 888 \end{array}$$

A) 9 B) 8 C) 7 D) 6 E) 5

## Question#16

. [Combinatorics, 7 Points]

There are 3 novels and 3 comic books on a bookshelf. Janet wants to select and read at least 2 novels and at most 2 comics from the shelf. In how many ways can she select books from the shelf?

A) 21 B) 22 C) 24 D) 27 E) 28

**Question#1**

[Algebra, 3 Points]

Each successive week, Luna saves as much money as she does in the previous three weeks. How much will she save in the seventh week, if she saves $25, $30, and $60 in the first three weeks?

A) $1285 B) $700 C) $675 D) $585 E) $380

**Question#2**

[Geometry, 3 Points]

How many integer values of x are there so that x cm, 4 cm, and 7 cm could be the side lengths of a triangle?

A) 5 B) 6 C) 7 D) 8 E) 9

**Question#3**

[Number Theory, 3 Points]

In a particular year, 25$^{th}$ of August is Thursday. What day is the 5$^{th}$ day of October of the same year?

A) Wednesday B) Thursday C) Friday D) Saturday E) Monday

**Question#4**

[Combinatorics, 3 Points]

How many whole numbers less than 100 can be formed using the digits 6, 7, 8 and 9 if a digit **cannot** be used more than once?

A) 12 B) 13 C) 14 D) 15 E) 16

**Question#5**

[Algebra, 5 Points]

The table below shows the average number of math practice questions students solve per day. If the average number of questions solved by one student in a day is 90, how many students solved 80 questions?

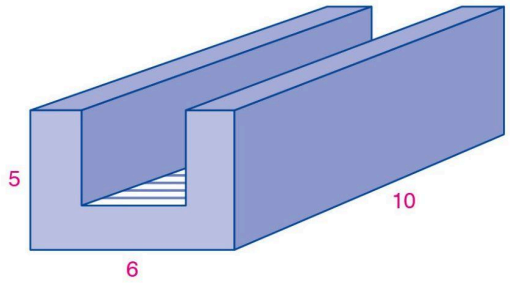
| Average Number of Math Practice Questions | 100 | 150 | 80 | 50 | 200 |
|---|---|---|---|---|---|
| Number of Students | 3 | 2 | X | 8 | 2 |

A) 6 B) 5 C) 4 D) 3 E) 2

## Question#6

[Geometry, 5 Points]

A square prism with base side length 4 cm and height 10 cm is removed from the rectangular prism with side lengths 5 cm, 6 cm, and 10 cm.
What is the volume of the remaining figure?




A) 140 $cm^3$ B) 150 $cm^3$ C) 160 $cm^3$ D) 170 $cm^3$ E) 180 $cm^3$

## Question#7

[Number Theory, 5 Points]

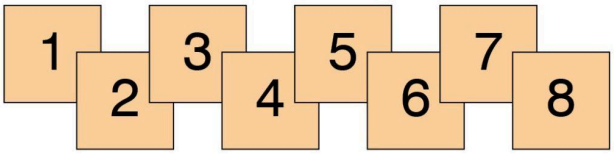
Nora multiplies two-digit number AA by 99 and gets four-digit number ABBA.
What is A + B?

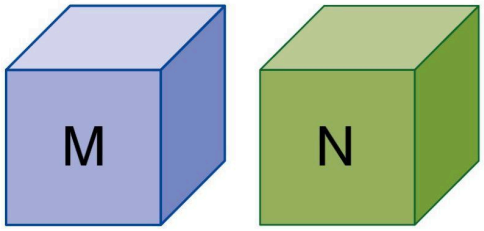
A) 15 B) 13 C) 11 D) 9 E) 7

## Question#8

[Combinatorics, 5 Points]

Eight cards numbered 1 to 8 are put into two boxes M and N so that the sum of the cards in box M is twice the sum of the cards in box N.




If there are exactly 3 cards in box N, then which of the following statements is definitely true?

A) Three cards in box N are odd numbers.
B) Three cards in box N are even numbers.
C) The card numbered 2 is not in box N.
D) The card numbered 6 is in box N.
E) Any three of those 8 numbers can be in box N.

## Question#9

[Algebra, 5 Points]

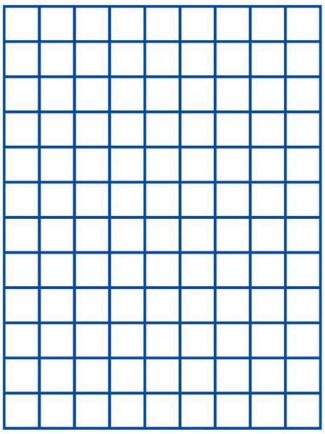
What is the value of $\frac{(0.02)\cdot(0.005)}{(0.4)\cdot(0.0015)}$ ?

A) $\frac{1}{2}$ B) $\frac{1}{3}$ C) $\frac{1}{4}$ D) $\frac{1}{5}$ E) $\frac{1}{6}$

## Question#10

. [Geometry, 5 Points]

Bob is putting a low fence around all four sides of a rectangular garden. The garden is 27 feet wide and 36 feet long.



Each section of fencing is 3 feet long. How many sections of fencing will Bob need?

A) 28 sections B) 32 sections C) 36 sections D) 42 sections E) 46 sections

## Question#11

. [Number Theory, 5 Points]

abc, bca, cab are all three-digit numbers. If

$500 < abc < 600$

$200 < bca < 300$

$300 < cab < 400$

then which of the following four-digit numbers is the largest?

A) 4abc B) ab09 C) bc17 D) ca90 E) acb5

## Question#12

. [Combinatorics, 5 Points]

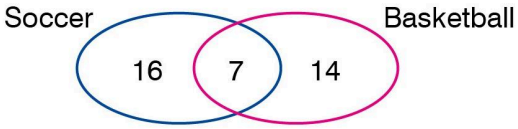
In how many ways can identical 3 red and 2 blue marbles be placed in a row?

A) 10 B) 12 C) 14 D) 15 E) 16

**Question#13**

. [Algebra, 7 Points]

The Venn diagram below shows the number of students who play soccer and basketball.
How many students play basketball **but not** soccer?

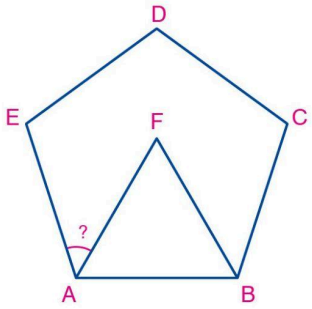



A) 30 B) 21 C) 16 D) 14 E) 7

**Question#14**

. [Geometry, 7 Points]

In the figure on the right, ABCDE is a regular pentagon and ABF is an equilateral triangle.
What is the measure of the angle EAF?




A) 58° B) 56° C) 52° D) 48° E) 46°

**Question#15**

. [Number Theory, 7 Points]

When the three-digit number **a0b** is divided by the two-digit number **a0**, we have

Divisor + Quotient + Remainder = 85

$$\begin{array}{r} \text{quotient} \\ \text{divisor}\,\big|\,\overline{\text{divident}} \\ -\,\underline{\qquad\qquad} \\ \text{remainder} \end{array}$$

What is the value of a × b?

A) 35 B) 28 C) 20 D) 18 E) 15

**Question#16**

. [Combinatorics, 7 Points]

Which of the following can be the six-digit code, from right to left, if the sum of the digits in the even numbered positions is equal to the sum of digits in the odd numbered positions?

A) 71□□92 B) 6□728□ C) 3□4151 D) 19□8□2 E) 293□3□

## Question #/1

[Algebra, 3 Points]

Yesterday, $\frac{3}{8}$ of 144 students in a contest gave their speeches. Today, half of the rest of the students in the contest gave their speeches. How many students **did not** give their speeches yet?

A) 46 B) 45 C) 44 D) 43 E) 42

## Question #/2

[Geometry, 3 Points]

What is the sum of the numbers of faces, vertices, and edges of a rectangular prism?

A) 22 B) 24 C) 26 D) 28 E) 30

## Question #3

[Number Theory, 3 Points]

What is the sum of all positive divisors of 72?

A) 144 B) 167 C) 173 D) 195 E) 197

## Question #4

[Combinatorics, 3 Points]

A member club is choosing a president, a vice president, and a treasurer. There are four members running for president, two members running for vice president, three members running for treasurer. In how many ways can these three people be chosen?

A) 6 B) 12 C) 18 D) 24 E) 36

## Question #5

[Algebra, 5 Points]

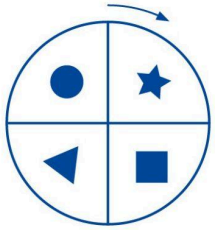
The difference between two numbers is 629. If the minuend is reduced by 90, and the subtrahend is reduced by x, the new difference will be 547. What is x?

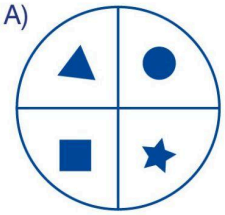
A) 9 B) 8 C) 7 D) 6 E) 5

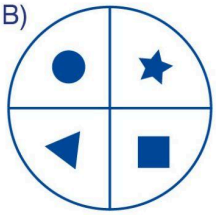
## Question #6

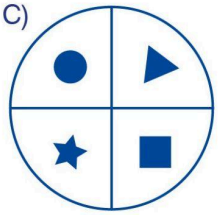
[Geometry, 5 Points]

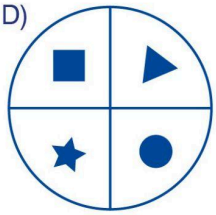
Which of the following will be the final view of the figure on the right, if it is rotated 270° clockwise?

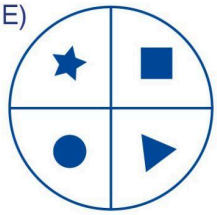


A) 

B) 

C) 

D) 

E) 

## Question #7

[Number Theory, 5 Points]

5 distinct three-digit numbers are added. Which of the following is the **greatest** possible sum of these 5 numbers?

A) 4985 B) 4987 C) 4990 D) 4993 E) 4995

## Question #8

[Combinatorics, 5 Points]

There are 7 fruit pieces of different kinds on a tray. How many selections of 3 pieces of fruit can Helen make if she **must** select the apple?

A) 35 B) 32 C) 24 D) 18 E) 15

## Question #9

[Algebra, 5 Points]

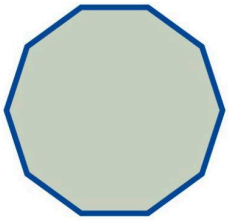
The sum of three numbers is 135. The third number is twice the second and the first number is 5 less than the second. What is the first number?

A) 70 B) 45 C) 40 D) 35 E) 30

## Question #10

[Geometry, 5 Points]

How many triangles can be obtained when we joined one of the vertices of a 10-sided polygon with each of its vertices?



A) 6 B) 7 C) 8 D) 9 E) 10

## Question #11

[Number Theory, 5 Points]

The operation is the multiplication of three-digit number ABC by 42 where each point represents a digit.
What is the product?

$$\begin{array}{r} ABC \\ \times \quad 42 \\ \hline \quad \ldots \\ +\ 8640 \\ \hline \quad \ldots\ldots \end{array}$$

A) 8974 B) 9072 C) 9164 D) 9254 E) 9382

## Question #/12

[Combinatorics, 5 Points]

How many "4 heads and 4 tails" outcomes are possible if a coin is flipped 8 times?

A) 70 B) 56 C) 35 D) 28 E) 21

## Question #13

[Algebra, 7 Points]

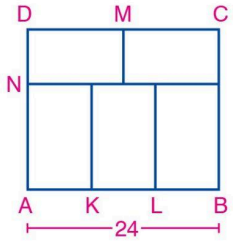
When Abigail cuts off $\frac{1}{6}$ of a straight wire, she notices that the midpoint of the wire moves 2 cm away.
What was the length of the wire at the beginning?

A) 12 cm B) 18 cm C) 24 cm D) 28 cm E) 30 cm

## Question #14

[Geometry, 7 Points]

ABCD is a big rectangle that is made up of 5 small identical rectangles. If the length of side AB is 24 cm, what is the length of BC?




A) 12 cm B) 16 cm C) 18 cm D) 20 cm E) 22 cm

## Question #15

[Number Theory, 7 Points]

AB and BA are two-digit numbers. Which of the following **cannot** be equal to AB – BA?

A) 9 B) 18 C) 36 D) 54 E) 81

## Question #16

[Combinatorics, 7 Points]

In how many ways can a family with three children be seated at a round table if the mother and father sit together?

A) 10 B) 12 C) 18 D) 24 E) 48

## Question #1

[Algebra, 3 Points]

Evaluate the expression.

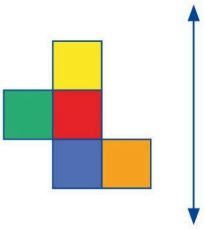
$$\frac{3}{1-\frac{1}{4}} - \frac{5}{2-\frac{1}{3}}$$

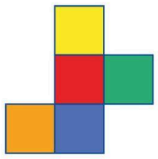
A) 1 B) $\frac{1}{2}$ C) $\frac{1}{3}$ D) $\frac{3}{2}$ E) $\frac{1}{5}$

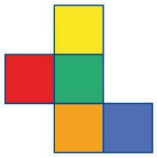
## Question #2

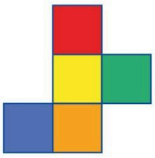
[Geometry, 3 Points]

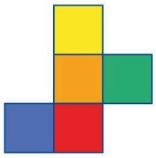
Which of the following figures is the reflection of the shape around the vertical line given?

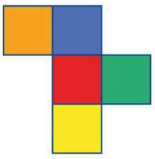


A) 

B) 

C) 

D) 

E) 

## Question #3

[Number Theory, 3 Points]

a and b are positive integers.

$$\frac{a}{4} + b = 8$$

What is the **greatest** possible value of a?

A) 16 B) 20 C) 24 D) 28 E) 32

## Question #4

[Combinatorics, 3 Points]

How many four-letter words can be formed by arranging the letters of the word ERIC if R and I must be next to each other?


A) 6 B) 9 C) 10 D) 12 E) 18

## Question #5

[Algebra, 5 Points]

What is the value of the expression?

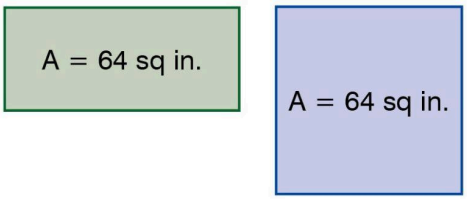
$$12 \div 2 + 3 \cdot (7 + 3 - 3 \cdot 3) - (7 - 2 \cdot 3)^2$$

A) 7 B) 8 C) 9 D) 10 E) 12

## Question #6

[Geometry, 5 Points]

A rectangle and a square both have the same area of 64 sq in. Which of the following can be the sum of their perimeters if the side lengths of both rectangle and square are whole numbers?

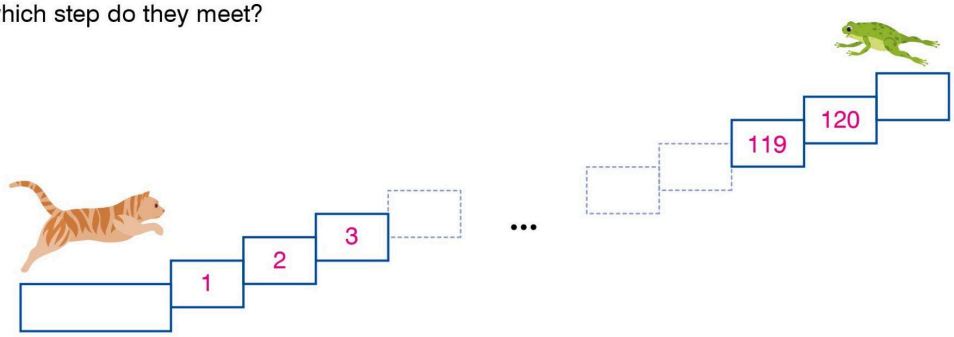



A) 72 cm B) 74 cm C) 76 cm D) 78 cm E) 80 cm

## Question #7

[Number Theory, 5 Points]

Every time the cat jumps up to the right 7 steps, the frog jumps down 3 steps to the left.
On which step do they meet?




A) 77 B) 78 C) 81 D) 84 E) 87

## Question #8

[Combinatorics, 5 Points]

Levi has either a bunch of 4 cm and 12 cm long sticks together. With which of the combinations below can he make a square, without breaking or overlapping the sticks?

A) 5 short and 2 long B) 3 short and 3 long C) 6 short
D) 4 short and 2 long E) 6 long

## Question #9

[Algebra, 5 Points]

The sum of four numbers is 80. Isabella subtracts a secret number from each of these four numbers and she gets 19, 6, 15 and 12 as the results. Which one of the following is one of those original four numbers?

A) 22 B) 23 C) 25 D) 27 E) 28

## Question #10

. [Geometry, 5 Points]

What are the new coordinates of the point (–7, 3) translated 4 units left and 5 units up?

A) (–3, 8) B) (–3, –2) C) (8, –11) D) (–11, –2) E) (–11, 8)

## Question #11

. [Number Theory, 5 Points]

What is the sum of all two-digit numbers having 3 for their unit's digit?

A) 481 B) 479 C) 477 D) 475 E) 473

## Question #12

. [Combinatorics, 5 Points]

Owen writes 8 numbers from 1 to 8 on a paper. He colors and adds five of these numbers and gets 19. Which of the following **cannot** be one of the uncolored numbers?

**1 2 3 4 5 6 7 8**

A) 1 B) 2 C) 3 D) 4 E) 5

## Question #13

. [Algebra, 7 Points]

What is the value of the expression if m and n are distinct nonzero digits?

$$\frac{mnm.n}{m.n} + \frac{m.n}{0.mn}$$

A) 11 B) 99 C) 101 D) 110 E) 111

## Question #14

. [Geometry, 7 Points]

How many lines do 7 points determine if three of the points are collinear?

A) 23 B) 22 C) 21 D) 20 E) 19

## Question #15

. [Number Theory, 7 Points]

MathCON boot-camp hosts teams with either 6 or 8 members.
How many teams can MathCON host at most, if there are 92 students attending?

A) 16 B) 15 C) 14 D) 13 E) 12

## Question #16

. [Combinatorics, 7 Points]

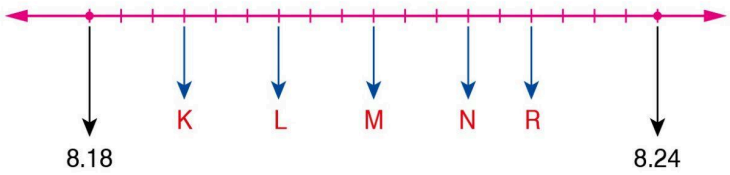
Jerry tosses a coin successively 6 times. In how many ways can Jerry get 3 heads and 3 tails?

A) 18 B) 20 C) 24 D) 30 E) 32

## Question #1

[Algebra, 3 Points]

The number line below is divided into equal parts.
Which statement is **false**?

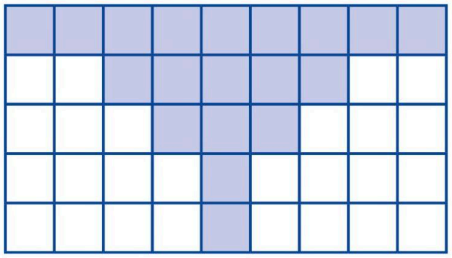



A) K = 8.19 B) L = 8.20 C) M = 8.21 D) N = 8.22 E) R = 8.23

## Question #2

[Geometry, 3 Points]

Susan's bathroom wall is covered with blue and white square tiles, as shown on the right. Each tile is 900 $cm^2$. What is the area of the blue region?

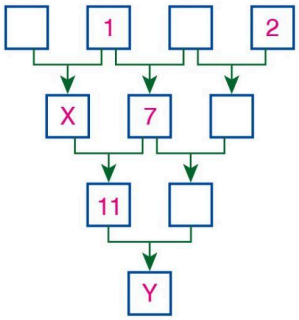


A) 17,100 $cm^2$ B) 16,200 $cm^2$ C) 15,300 $cm^2$ D) 14,400 $cm^2$ E) 13,500 $cm^2$

## Question #3

[Number Theory, 3 Points]

In the figure below, each number in a box is the sum of the two boxes above it.




What is the sum X + Y?

A) 21 B) 23 C) 25 D) 28 E) 30

## Question #4

[Combinatorics, 3 Points]

At a business seminar there are six representatives, and each person shakes hands with every other person. How many handshakes are there?

A) 12 B) 15 C) 20 D) 24 E) 30

## Question #5

[Algebra, 5 Points]

Alex makes decimal numbers using each digit 1, 2, and 9 exactly once. If the whole number part of these decimal numbers always have two digits, then what is the sum of all possible decimal numbers?

A) 262.4 B) 263.6 C) 264.8 D) 265.6 E) 266.4

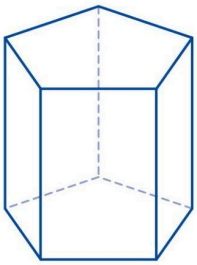
## Question #6

[Geometry, 5 Points]

In the given figure:

- the number of faces is, “a”
- the number of edges is, “b”
- the number of vertices is, “c”

What is the value of $a \cdot b - c$?



A) 53 B) 55 C) 75 D) 83 E) 95

## Question #7

[Number Theory, 5 Points]

A tree seedling is growing 17 cm per year. What was the height of it at the end of 4th year, if its height was 181 cm at the end of 8th year?

A) 249 cm B) 232 cm C) 130 cm D) 113 cm E) 96 cm

## Question #8

[Combinatorics, 5 Points]

Lisa wants to get Figure 2 from Figure 1 by cutting it into pieces.

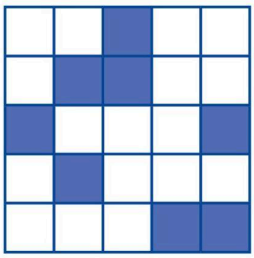


Figure 1

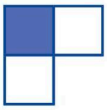


Figure 2

**At most** how many Figure 2 can she have?

A) 4 B) 5 C) 6 D) 7 E) 8

## Question #9

[Algebra, 5 Points]

$\frac{A}{13}$ is a proper and $\frac{25}{B}$ is an improper fraction, then what is the greatest value of A + B?

A) 36 B) 39 C) 40 D) 41 E) 42

## Question #10

. [Geometry, 5 Points]

- A _____ is a polygon with six sides.
- The longest side of a right triangle is the _____ .
- The legs of an _____ trapezoid have the same length.

Which of the following make the above statements true, respectively?

A) hexagon, perimeter, isosceles B) pentagon, hypotenuse, isosceles

C) hexagon, hypotenuse, equilateral D) pentagon, hypotenuse, equilateral

E) hexagon, hypotenuse, isosceles

## Question #11

. [Number Theory, 5 Points]

For distinct positive integers a, b, and c

$$a + b = \frac{21}{c}$$

Which of the following expression's result is **always** even?

A) $a \cdot b + c$ B) $a + b \cdot c$ C) $a \cdot c + b$ D) $a \cdot c \cdot b$ E) $a \cdot c + b \cdot c$

## Question #12

. [Combinatorics, 5 Points]

Three-digit numbers, with all digits different are formed using 1, 2, 3, 4, or 5.
In how many of these three-digit numbers are 2 on the left of digit 3?

A) 4 B) 5 C) 6 D) 8 E) 9

## Question #13

. [Algebra, 7 Points]

Which of the following is equal to the given expression?

$$\frac{0.02 + 0.005}{0.05}$$

A) $\frac{1}{2}$ B) $\frac{1}{5}$ C) $\frac{1}{10}$ D) $\frac{1}{20}$ E) $\frac{1}{40}$

## Question #14

. [Geometry, 7 Points]

An apartment building will be constructed inside rectangular shaped land with dimensions 240 yards by 150 yards. The city ordinance requires having a green area around the building with 10 yards width. What is the total area of this green area?

A) 7400 $yd^2$ B) 8200 $yd^2$ C) 14300 $yd^2$ D) 14800 $yd^2$ E) 28600 $yd^2$

## Question #15

. [Number Theory, 7 Points]

Evelyn lists all three-digit numbers, where the digit in the middle is greater than the sum of first and last digits. What is the smallest possible sum of such 3 consecutive three-digit numbers?

A) 456 B) 423 C) 393 D) 373 E) 363

## Question #16

. [Combinatorics, 7 Points]

Nolan rolled four different colored dice (blue, red, green, and yellow) in the order given and scored a total of 22 points.
How many different orders are possible?

A) 8 B) 9 C) 10 D) 12 E) 15

## Question #1

[Algebra, 3 Points]

Evaluate the given expression.

$$(9.5 + 4.5)^2 - 4 \cdot (9.5) \cdot (4.5)$$

A) 4 B) 9 C) 16 D) 25 E) 36

## Question #2

[Geometry, 3 Points]

Which of the following is formed when a right triangle is rotated about one of its legs?

A) pyramid B) rectangular prism C) cone D) cylinder E) cube

## Question #3

[Number Theory, 3 Points]

There is a relation between the numbers in the first row and the numbers underneath them.

| | | | | | |
|---|---|---|---|---|---|
| 12 | 25 | 42 | A | 88 | 117 |
| 3 | 5 | 7 | 9 | 11 | B |

What is the sum A + B?

A) 72 B) 74 C) 76 D) 78 E) 80

## Question #4

[Combinatorics, 3 Points]

Elijah is using the digits 9, 1, 7 and 0 to make four-digit numbers, using all the digits in each number.
What is the difference between the greatest and least possible odd numbers?

A) 10789 B) 10780 C) 8622 D) 7920 E) 7631

## Question #5

[Algebra, 5 Points]

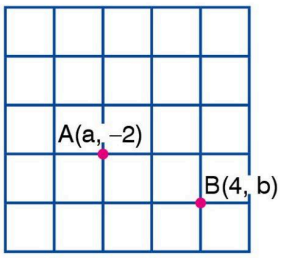
Robert is 22 years younger than his mother and 25 years younger than his father.
His father will be 67 years old when he will be his mother's present age.
How old is Robert?

A) 19 B) 20 C) 22 D) 24 E) 25

## Question #6

[Geometry, 5 Points]

Given the figure, points A(a, –2) and B(4, b) are in the coordinate plane.
What is the sum a + b?




A) 1 B) 0 C) –1 D) 2 E) 3

## Question #7

[Number Theory, 5 Points]

When 313 is divided by the number x, the quotient is 18 and the remainder is y.
What is the sum x + y?

A) 17 B) 23 C) 24 D) 27 E) 33

## Question #8

[Combinatorics, 5 Points]

Five people, Thomas, Amy, Mark, Debra, and Levi are waiting in the line for a music concert tickets.
In how many ways can they be in the line, if Debra **will not** be next to Amy?

A) 84 B) 72 C) 70 D) 64 E) 48

## Question #9

[Algebra, 5 Points]

The cost price of an item in a store is the amount the store paid for the item. In a store, the cost price of a sweater is $200 and the cost price of a jacket is $300. The store sells the jacket for 20% more than its cost price and the sweater for 25% less than its cost price.
Which statement is true?

A) The store did not earn or lose any money on the two sales.

B) The store made a $10 profit on the two sales.

C) The store made a $12 profit on the two sales.

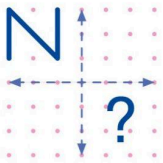
D) The store lost $10 on the two sales.

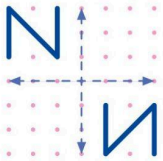
E) The store lost $12 on the two sales.

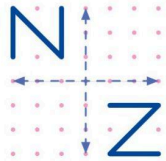
## Question #10

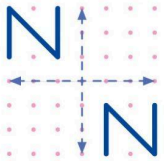
[Geometry, 5 Points]

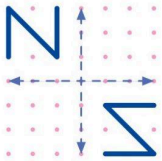
Flora reflects the letter N over two lines back to back.
What will the image look like?

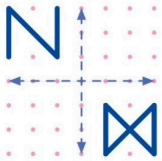



A) 

B) 

C) 

D) 

E) 

## Question #11

[Number Theory, 5 Points]

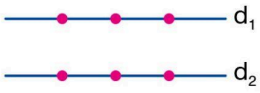
The product of the digits a four-digit number is 100.
Which of the following must be one of its digits?

A) 0 B) 1 C) 2 D) 4 E) 5

## Question #12

[Combinatorics, 5 Points]

There are three points on each lines $d_1$ and $d_2$.
How many different triangles can be drawn using any three of these points as vertices?




A) 6 B) 9 C) 12 D) 15 E) 18

## Question #13

[Algebra, 7 Points]

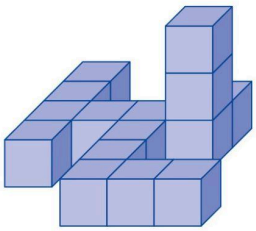
The difference of two numbers that are equidistant from 5 on the number line is 5.
What is the product of these two numbers?

A) $\frac{75}{2}$ B) $\frac{5}{2}$ C) $\frac{15}{2}$ D) $\frac{75}{4}$ E) $\frac{25}{4}$

## Question #14

. [Geometry, 7 Points]

The given figure on the right is composed of identical cubes with side length of 2 cm.
What is the surface area of the figure?



A) 260 $cm^2$ B) 256 $cm^2$ C) 252 $cm^2$ D) 248 $cm^2$ E) 244 $cm^2$

## Question #15

. [Number Theory, 7 Points]

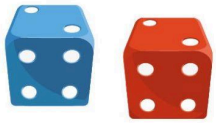
$x - y$, $y$, and $x + y$ are three consecutive integers in increasing order.
What is the value of $x \cdot y$?

A) 1 B) 2 C) 3 D) 4 E) 5

## Question #16

. [Combinatorics, 7 Points]

Two dice are rolled, and their numbers are multiplied.
How many cases are there that the product is prime?



A) 3 B) 4 C) 5 D) 6 E) 9

## Question #1

[Algebra, 3 Points]

Sum of the ages of John and David is 25. What will be the sum of their ages in 15 years?

A) 40 B) 55 C) 60 D) 70 E) 75

## Question #2

[Geometry, 3 Points]

The height of a rectangular window is three times its width.
If the width of the window is 45 cm, then what is the perimeter?

A) 360 cm B) 320 cm C) 300 cm D) 270 cm E) 240 cm

## Question #3

[Number Theory, 3 Points]

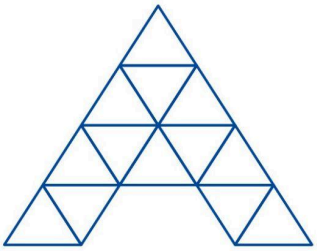
What is the sum of the counting numbers from 2010 to 2021? (including 2010 and 2021)?

A) 24,186 B) 24,176 C) 23,186 D) 22,176 E) 22,165

## Question #4

[Combinatorics, 3 Points]

What is the total number of triangles in the following figure?



A) 21 B) 20 C) 19 D) 18 E) 17

## Question #5

[Algebra, 5 Points]

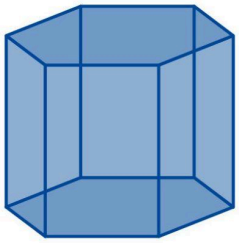
What is one quarter of the number $4^{44}$?

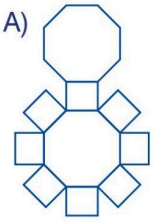
A) $2^{88}$ B) $2^{87}$ C) $2^{86}$ D) $2^{85}$ E) $2^{84}$

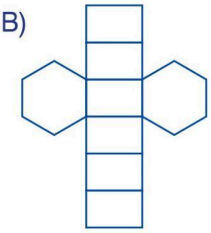
## Question #6

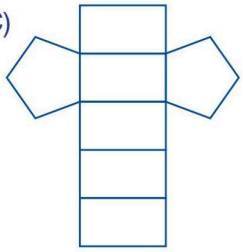
[Geometry, 5 Points]

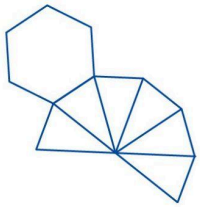
Which of the following is the correct net for the solid shape on the right?

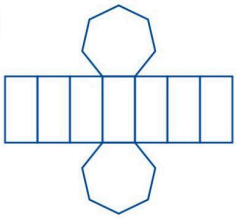


A) 

B) 

C) 

D) 

E) 

## Question #7

[Number Theory, 5 Points]

What is the sum of the terms in the 15th brackets?

(1, 2, 3, 4), (5, 6, 7, 8), (9, 10, 11, 12), …

A) 250 B) 234 C) 218 D) 202 E) 186

## Question #8

[Combinatorics, 5 Points]

There are five finalists in a long-jump race.
Medals are awarded for first, second and third place.
In how many different ways could the medals be awarded?


A) 120 B) 72 C) 60 D) 48 E) 24

## Question #9

[Algebra, 5 Points]

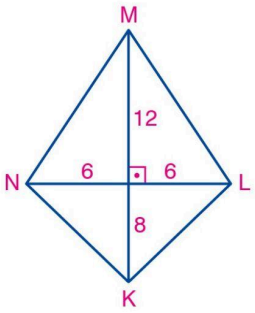
On the number line, the distances between the number $\frac{5}{4}$ and the numbers $\frac{4}{3}$, $\frac{6}{5}$, and $\frac{7}{6}$ are A, B, and C respectively.
Which of the following is the correct order?

A) $A < B < C$ B) $A = B < C$ C) $B < A < C$ D) $B < A = C$ E) $B < C < A$

## Question #10

. [Geometry, 5 Points]

Figure KLMN is a kite made up of four right triangles as shown.
What is the area of the kite KLMN?




A) 108 square units B) 110 square units C) 112 square units
D) 120 square units E) 144 square units

## Question #11

. [Number Theory, 5 Points]

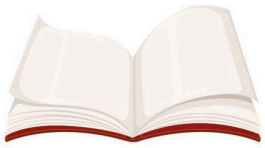
Composite numbers are positive integers formed by multiplying two smaller positive integers.
The first four composite numbers are 4, 6, 8, and 9.
What is the sum of the first seven composite numbers that are greater than 50?

A) 391 B) 389 C) 387 D) 385 E) 383

## Question #12

. [Combinatorics, 5 Points]

There are 500 pages in a book, numbered 1, 2, 3, etc.
How many times does the digit 1 appear in the page numbers?



A) 150 B) 176 C) 180 D) 190 E) 200

## Question #13

. [Algebra, 7 Points]

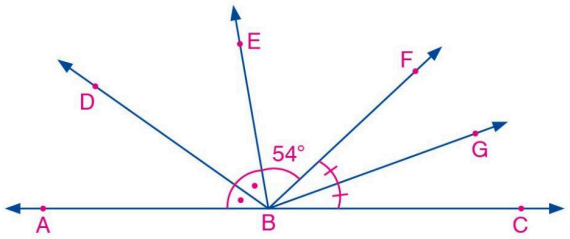
A fitness center offers membership packages for 1, 2, or 3 months, where 3-month membership includes one month free. So far, 120 membership packages for 215 months (excluding free months) have been sold. Considering 24 months free membership gift, how many 1-month membership packages were sold?

A) 60 B) 54 C) 49 D) 47 E) 24

## Question #14

. [Geometry, 7 Points]

In the given figure, points A, B, C are colinear.
Ray BD is the angle bisector of angle ABE.
Ray BG is the angle bisector of angle CBF.
The measure of the angle EBF is 54°.
What is the measure of the angle DBG?




A) 116° B) 117° C) 118° D) 124° E) 126°

## Question #15

. [Number Theory, 7 Points]

John is a florist. When he ties up roses in a bunch of 3 roses, or 6 roses, or 8 roses each, he ends up being 2 roses short.
Which of the following is the **minimum** number of roses he will have, if he has more than 150 roses?

A) 194 roses B) 192 roses C) 190 roses D) 170 roses E) 168 roses

## Question #16

. [Combinatorics, 7 Points]

The code box on an electronic alarm is activated by a three digit code using digits 5 through 9.
What is the **maximum** number of attempts needed to cancel the alarm?


A) 125 B) 120 C) 64 D) 60 E) 27

## Question #1

[Algebra, 3 Points]

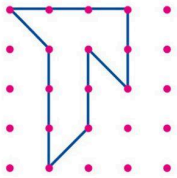
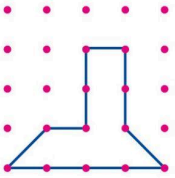
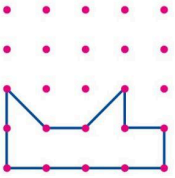
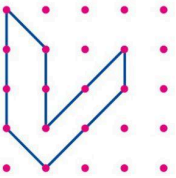
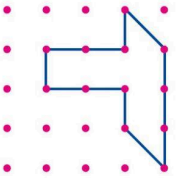
If 2AA and A27 are three-digit numbers and $\frac{2AA}{A27}$ and $\frac{4}{7}$ are equivalent fractions, then what is A?

A) 2 B) 3 C) 4 D) 5 E) 6

## Question #2

[Geometry, 3 Points]

In which figure is the largest area shown on the dot paper?

A)  B)  C)  D)  E) 

## Question #3

[Number Theory, 3 Points]

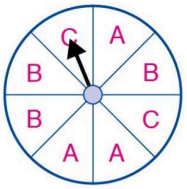
Which of the following numbers is the **greatest** prime factor of 690?

A) 69 B) 23 C) 5 D) 3 E) 2

## Question #4

[Combinatorics, 3 Points]

Jasmine will spin the spinner 600 times.
How many times can she expect the spinner to land on A or C?




A) 375 B) 350 C) 325 D) 250 E) 225

## Question #5

[Algebra, 5 Points]

Which of the following describes the rule for the table?

| x | y |
|---|---|
| 1 | 6 |
| 2 | 11 |
| 3 | 16 |
| 4 | 21 |

A) $y = 5x + 3$ B) $y = 3x + 2$ C) $y = 2x + 7$ D) $y = 4x + 2$ E) $y = 5x + 1$

## Question #6

[Geometry, 5 Points]

What is the angle between hour hand and minute hands at 9:10?


A) 130° B) 135° C) 140° D) 142.5° E) 145°

## Question #7

[Number Theory, 5 Points]

In the equation, the letters A and B represent different digits.
What is the value of A + B?

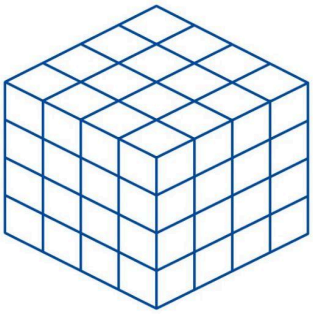
$$\begin{array}{cccc} & 8 & 8 & B \\ & 3 & A & B \\ + & A & A & B \\ \hline 2 & 0 & 4 & A \end{array}$$

A) 13 B) 15 C) 16 D) 17 E) 18

## Question #8

[Combinatorics, 5 Points]

The cube shown below is made of 64 unit cubes.
All faces of the large cube are then painted yellow.
How many unit cubes have **at least** two painted yellow faces?



A) 24 B) 28 C) 30 D) 32 E) 34

## Question #9

[Algebra, 5 Points]

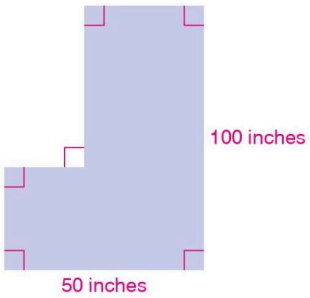
Dividing a number by 0.8 is equivalent to multiplying the same number by

A) 8 B) 4.5 C) 1.25 D) 0.8 E) 0.125

## Question #10

. [Geometry, 5 Points]

What is the perimeter of the figure?




A) 450 inches B) 400 inches C) 350 inches D) 300 inches E) 200 inches

## Question #11

. [Number Theory, 5 Points]

Karen has days off on Sundays.

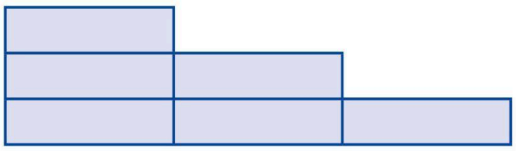
**At most** how many days off can she take in any back to back three months?

A) 11 B) 12 C) 13 D) 14 E) 15

## Question #12

. [Combinatorics, 5 Points]

How many rectangles of any size are in the figure?



A) 11 B) 12 C) 13 D) 14 E) 15

## Question #13

. [Algebra, 7 Points]

The average of six different whole numbers is $a + 15$.

If each of these six numbers is decreased by 2 then the new average will be $2a + 4$.

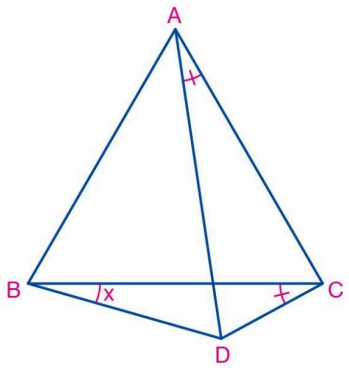
What is the **highest** possible value of the least one of these six numbers at the beginning?

A) 21 B) 22 C) 23 D) 24 E) 25

## Question #14

. [Geometry, 7 Points]

In the given figure,
ABC is an equilateral triangle,
AD = AC, and
m∠DAC = m∠DCB.
What is m∠DBC = x?




A) 5° B) 10° C) 15° D) 20° E) 25°

## Question #15

. [Number Theory, 7 Points]

If a, b, and c are whole numbers with

$$a < b < c$$

$$a \cdot c + b = 11 \cdot a$$

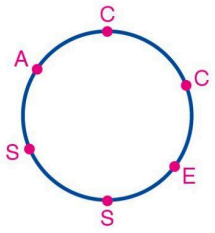
then, what is the **greatest** value of $a \cdot b \cdot c$?

A) 90 B) 96 C) 144 D) 288 E) 320

## Question #16

. [Combinatorics, 7 Points]

On a circle, how many ways can the letters of the word ACCESS be arranged?

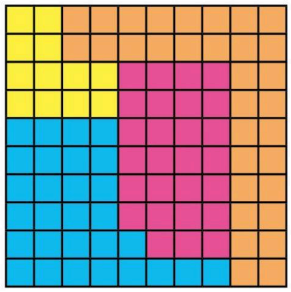



A) 24 B) 30 C) 48 D) 60 E) 120

## Question #1

[Algebra, 3 Points]

The big square below is divided into 100 identical small squares and shaded in four different colors.



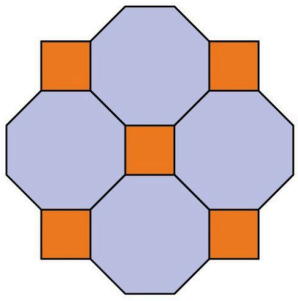
Which ratio is correct?

A) $\frac{\square}{\square} = \frac{5}{8}$ B) $\frac{\square}{\square} = \frac{15}{14}$ C) $\frac{\square}{\square} = \frac{16}{15}$ D) $\frac{\square}{\square} = \frac{9}{4}$ E) $\frac{\square}{\square} = \frac{2}{5}$

## Question #2

[Geometry, 3 Points]

The given figure is made up of regular polygons (squares and octagons). If the perimeter of one square is 21 cm, then what is the perimeter of the whole shape?



A) 100 cm B) 102.5 cm C) 105 cm D) 107.5 cm E) 110 cm

## Question #3

[Number Theory, 3 Points]

The numbers below follow a pattern.

$$144, 24, 4, \frac{2}{3}, \ldots$$

Which of the following must be the next number in the pattern?

A) $\frac{2}{9}$ B) $\frac{1}{9}$ C) $\frac{1}{6}$ D) $\frac{1}{3}$ E) $\frac{1}{2}$

## Question #4

[Combinatorics, 3 Points]

5 people in a meeting room shake hands with each other at the beginning and at the end of the meeting.
What was the total number of handshakes?

A) 20 B) 22 C) 24 D) 26 E) 28

## Question #5

[Algebra, 5 Points]

The average of six weights is 15 grams.
This set of six weights then increased by another weight of 8 grams.
What is the average of the seven weights?

A) 15 grams B) 14 grams C) 13 grams D) 12 grams E) 11 grams

## Question #6

[Geometry, 5 Points]

How many degrees are there in the angle between two hands of a clock at 8:30 pm?


A) 45° B) 60° C) 75° D) 80° E) 90°

## Question #7

[Number Theory, 5 Points]

The factors of 42 are: 1, 2, 3, **A**, 7, **B**, 21, 42.
The factors of 54 are: 1, 2, 3, 6, **C**, **D**, 27, 54.
The factors of 96 are: 1, 2, 3, 4, **E**, 8, 12, 16, 24, **F**, 48, 96.
What is the sum **A** + **B** + **C** + **D** + **E** + **F**?

A) 73 B) 75 C) 85 D) 90 E) 95

## Question #8

[Combinatorics, 5 Points]

Jason forms decimal numbers using each digit 0, 1, 2, 7 and 9 only once.
The whole number parts will have two digits.
What is the difference between the **largest** and the **smallest** decimal numbers Jason can form?

A) 84.139 B) 85.837 C) 86.931 D) 87.319 E) 89.193

## Question #9

[Algebra, 5 Points]

Which of the following is a possible sum of three consecutive even integers?

A) 140 B) 142 C) 144 D) 148 E) 152

## Question #10

. [Geometry, 5 Points]

How many different isosceles triangles have integer side lengths and perimeter 37 cm?

A) 12 B) 11 C) 10 D) 9 E) 8

## Question #11

. [Number Theory, 5 Points]

The difference of two numbers is 52, and their quotient is 5 (i.e. when one number is divided by the other, the answer is 5).
What is the sum of two numbers?

A) 54 B) 60 C) 66 D) 72 E) 78

## Question #12

. [Combinatorics, 5 Points]

Digits of the decimal number 0.461 are rearranged.
For example, 6.410, 10.64, or 416.0 can be obtained.
How many rearranged decimal numbers are less than 4?

A) 12 B) 10 C) 8 D) 9 E) 6

## Question #13

. [Geometry, 7 Points]

What is the **greatest** number of pieces a circle can be divided into using 5 straight lines?

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

## Question #14

. [Geometry, 7 Points]

What is the **greatest** number of pieces a circle can be divided into using 5 straight lines?

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

## Question #15

. [Number Theory, 7 Points]

Given that, f(A) = Sum of the prime factors of A.
For example, f(60) = 2 + 3 + 5 = 10.
What is the value of f(2022) + f(2023)?

A) 366 B) 364 C) 362 D) 360 E) 358

## Question #16

. [Combinatorics, 7 Points]

Ava and Bella ask Camila to choose one of the following numbers.

21, 23, 41, 45, 63

Camila chooses one of the numbers and tells its units digit to Ava and tens digit to Bella.
Then Ava says:

"I could not find the chosen number."

Finally, Bella says:

"I could not find the number first but now I know the chosen number."

What number did Camila chose?

A) 21 B) 23 C) 41 D) 45 E) 63

## Question #1

[Algebra, 3 Points]

22 more than one-third of a number is equal to four times the number itself.
What is the number?

A) 12 B) 9 C) 8 D) 6 E) 3

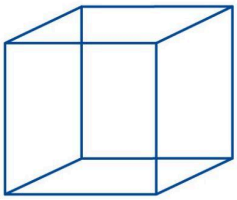
## Question #2

[Geometry, 3 Points]

A cube has

I. e edges,
II. c corners, and
III. f faces.

Then, what is the value of $e \cdot f \cdot c$?



A) 528 B) 540 C) 552 D) 564 E) 576

## Question #3

[Number Theory, 3 Points]

Which of the following numbers has the **smallest** prime factor?

A) 51 B) 49 C) 35 D) 23 E) 17

## Question #4

[Combinatorics, 3 Points]

How many different combinations of \$1 bills and \$5 bills can be used to make a total of \$33 if the order does not matter?


A) 10 B) 9 C) 8 D) 7 E) 6

## Question #5

[Algebra, 5 Points]

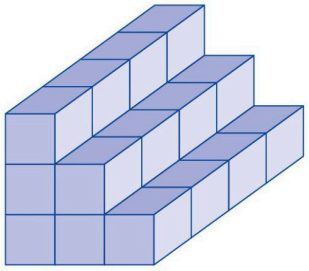
Ella is a clothing salesperson. On Monday, she sold $\frac{2}{5}$ of the blue shirts, and on Tuesday, she sold $\frac{5}{6}$ of the rest of the blue shirts.
What fraction of the shirts remained to be available for sale on Wednesday?

A) $\frac{1}{10}$ B) $\frac{2}{15}$ C) $\frac{1}{6}$ D) $\frac{1}{5}$ E) $\frac{4}{15}$

## Question #6

[Geometry, 5 Points]

A ladder-shaped figure made up of identical cubes shown on the right.
Exactly how many cubes are completely out of your sight?



A) 4 B) 8 C) 9 D) 10 E) 11

## Question #7

[Number Theory, 5 Points]

What is the multiplication of the first five prime numbers as Roman numeral?

A) MMCCX B) MMCCCXV C) MMCCCX D) MMCDX E) MMCDXX

## Question #8

[Combinatorics, 5 Points]

The digits 2, 3, and 8 are each used once to form even numbers.
How many numbers can be formed?

A) 14 B) 13 C) 12 D) 11 E) 10

## Question #9

[Algebra, 5 Points]

Which problem situation is represented by the equation: $60 + 3x = 250$?

A) Mark has \$60. He started with \$250. Each of his 3 friends gave him the same amount of money (x). How much money did each friend give Mark?

B) Mark has \$250. He started with \$60. Each of his 3 friends gave him the same amount of money (x). How much money did each friend give Mark?

C) Mark has \$60. He gave each of his 3 friends the same amount of money (x). How many friends have \$250?

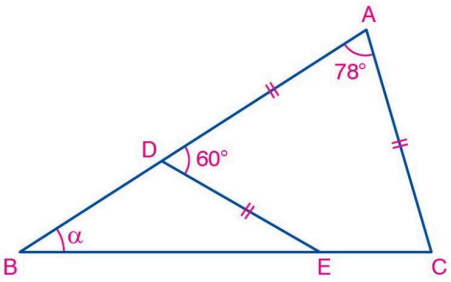
D) Mark has \$250. He gave each of his 60 friends the same amount of money (x). How much money did Mark give to each friend?

E) Mark has \$250. He gave each of his 3 friends the same amount of money (x). How many friends have \$60?

## Question #10

. [Geometry, 5 Points]

In the given figure,




ABC is a triangle,
AD = AC = DE,
m∠ADE = 60°, and
m∠BAC = 78°.

What is m∠ABC = $\alpha$?

A) 24° B) 23° C) 22° D) 21° E) 19°

## Question #11

. [Number Theory, 5 Points]

A list of whole numbers from 1 to 30 is written on a sheet of paper.
All the multiples of 5 are then struck off from the list.
What is the last digit of the multiplication of the remaining numbers?

A) 8 B) 6 C) 4 D) 3 E) 2

## Question #12

. [Combinatorics, 5 Points]

What is the number of three-digit positive integers whose sum of the digits is 5?

A) 15 B) 16 C) 17 D) 19 E) 21

## Question #13

. [Algebra, 7 Points]

The value of the 6 in 37.286 is $\frac{a}{b}$ times the value of the 6 in 12.768.

The value of the 2 in 37.286 is $\frac{c}{d}$ times the value of the 2 in 12.768.

The value of the 7 in 37.286 is $\frac{e}{f}$ times the value of the 7 in 12.768.

What is the value of $\frac{e}{f} - \frac{c}{d} - \frac{a}{b}$?

A) $\frac{49}{50}$ B) $\frac{49}{5}$ C) $\frac{99}{10}$ D) $\frac{98}{5}$ E) $\frac{99}{5}$

## Question #14

. [Geometry, 7 Points]

Which explanation about rhombuses is **not** correct?

A) All rhombuses are parallelograms, but not all parallelograms are rhombuses.

B) All squares are rhombuses.

C) A rhombus is a quadrilateral with four equal-length sides.

D) Opposite angles of a rhombus are equal.

E) All rhombuses have exactly one pair of parallel sides.

## Question #15

. [Number Theory, 7 Points]

x, y, and z are distinct numbers. Exactly one of the following statements is true.

I. y is the biggest number.
II. x is not the biggest number.
III. z is not the smallest number.

Which of the following orders is correct?

A) $x > z > y$ B) $x > y > z$ C) $y > z > x$ D) $y > x > z$ E) $z > x > y$

## Question #16

. [Combinatorics, 7 Points]

If a, b, c are three counting numbers, and

$$a \cdot b + c = 6$$

then, how many different ordered triples (a, b, c) are there?

A) 12 B) 10 C) 9 D) 8 E) 6

## Question #1

[Algebra, 3 Points]

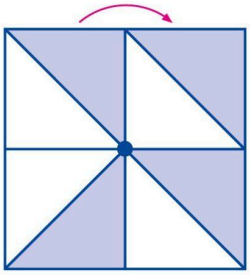
How many ounces do 12 tons of banana weigh given that there are 16 ounces in a pound and 2,000 pounds in a ton?

A) 384,000 B) 192,000 C) 3840 D) 24,000 E) 384

## Question #2

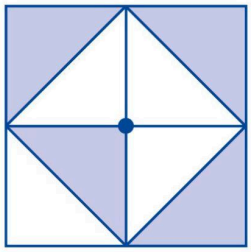
[Geometry, 3 Points]

The square in the figure is rotated clockwise as shown.

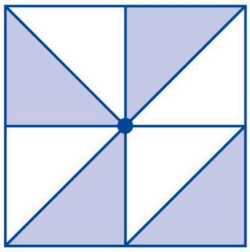


Which of the following figures is possible after the rotation?

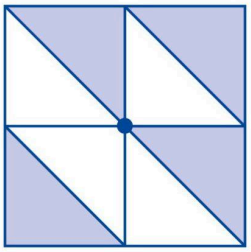
A)



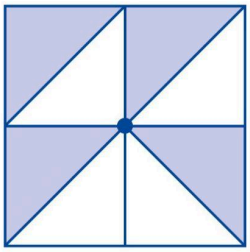
B)



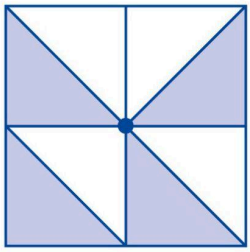
C)



D)



E)



## Question #3

[Number Theory, 3 Points]

What is the value of M, if the four-digit number 26M6 is divisible by 9?

A) 3 B) 4 C) 6 D) 7 E) 8

## Question #4

[Combinatorics, 3 Points]

How many distinct hair styles can be made with four different wigs, and two of three different hair accessories?

A) 24 B) 18 C) 15 D) 14 E) 12

## Question #5

[Algebra, 5 Points]

Which of the following is equal to $\left(\frac{3}{1-\frac{2}{3}}-\frac{3}{2+\frac{1}{4}}\right)\div\frac{23}{9}$ ?

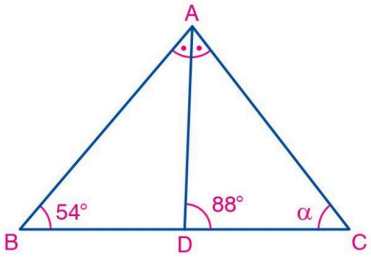
A) 3 B) 4 C) 6 D) 8 E) 9

## Question #6

[Geometry, 5 Points]

In the given figure,

ABC is a triangle,
AD is the angle bisector,
$m\angle ABC = 54°$, and
$m\angle ADC = 88°$,




then, what is $m\angle ACB = \alpha$?

A) 48° B) 52° C) 54° D) 58° E) 60°

## Question #7

[Number Theory, 5 Points]

A perfect square is a number that is the square of an integer.
For example, 1, 4, and 81 are perfect squares, since $1 = 1 \cdot 1$, $4 = 2 \cdot 2$, and $81 = 9 \cdot 9$.
What is the **biggest** four-digit perfect square?

A) 9972 B) 9889 C) 9801 D) 9604 E) 9409

## Question #8

[Combinatorics, 5 Points]

For the whole numbers x and y, if

$$x + y + x \cdot y = 111$$

then, what is the **least** value of $x + y$?

A) 20 B) 21 C) 30 D) 42 E) 56

## Question #9

[Algebra, 5 Points]

If $A = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4}$ and $B = 2 + \frac{1}{2} + \frac{4}{3} + \frac{3}{4}$

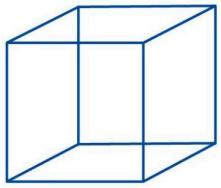
then, what is the difference $B - A$?

A) 6 B) 4 C) 3 D) 2 E) 1

## Question #10

. [Geometry, 5 Points]

Each of 12 edges of a cube is colored either red or green.
Every face of the cube has at least one red edge.
What is the **least** number of red edges?



A) 6 B) 5 C) 4 D) 3 E) 2

## Question #11

. [Number Theory, 5 Points]

Which of the following can be the multiplication of three consecutive even numbers?

A) 198 B) 196 C) 194 D) 192 E) 190

## Question #12

. [Combinatorics, 5 Points]

For the whole numbers a, b, and c,

$$a + b + c = 4$$

How many different ordered triples (a, b, c) are there?

A) 10 B) 12 C) 13 D) 14 E) 15

## Question #13

. [Algebra, 7 Points]

For the whole numbers a, b, and c, if

$$\frac{a}{b} = \frac{1}{3}$$

$$\frac{b}{c} = \frac{2}{7}$$

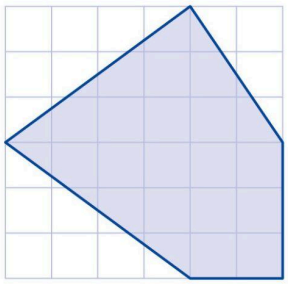
then, what is the **smallest** value of the sum a + b + c?

A) 14 B) 17 C) 19 D) 21 E) 29

## Question #14

. [Geometry, 7 Points]

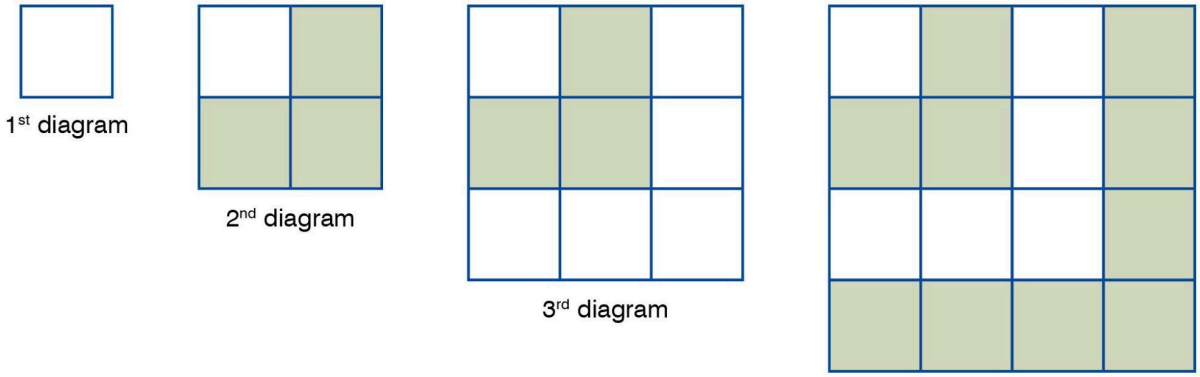
The figure is consists of 36 identical squares. What is the ratio of the unshaded region to the shaded region?



A) $\frac{7}{5}$ B) $\frac{7}{12}$ C) $\frac{5}{7}$ D) $\frac{3}{5}$ E) $\frac{5}{12}$

## Question #15

. [Number Theory, 7 Points]




Based on the above pattern, how many more shaded squares than unshaded squares will be in the $50^{th}$ diagram in the pattern?

A) 200 B) 150 C) 100 D) 75 E) 50

## Question #16

. [Combinatorics, 7 Points]

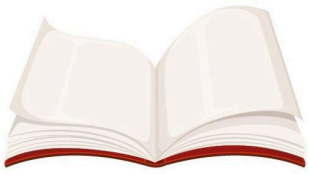
Dr. Aria is on call every six days. If she was on her third call on Wednesday, what day will she be on her 25th call?

A) Friday B) Thursday C) Wednesday D) Tuesday E) Monday

## Question #1

[Algebra, 3 Points]

Kayla reads $\frac{7}{12}$ of a 240 pages book on Tuesday. She reads $\frac{1}{5}$ of the rest of the book on Wednesday and finished reading the book on Thursday. How many pages did she read on Thursday?

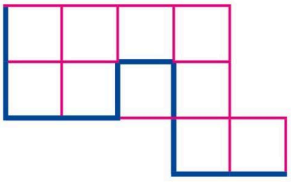


A) 80 B) 75 C) 70 D) 65 E) 60

## Question #2

[Geometry, 3 Points]

The figure shows a board where each small square has an area of 9 $cm^2$. What is the length of the thick blue line?



A) 30 cm B) 33 cm C) 36 cm D) 39 cm E) 42 cm

## Question #3

[Number Theory, 3 Points]

Patricia represented the length of an insect (centimeters) in expanded notation.

$$7 \times 100 + \left(5 \times \frac{1}{100}\right) + \left(3 \times \frac{1}{1{,}000}\right)$$

What is this number in standard form?

A) 70,053 B) 700,53 C) 700,053 D) 7,053 E) 70,53

## Question #4

[Combinatorics, 3 Points]

There are 24 different four-digit positive integers that can be made by arranging the digits 6, 7, 8, 9. When these integers are listed from smallest to largest what is the 7th integer if the first integer is 6789?

A) 7896 B) 7869 C) 7698 D) 7689 E) 6987

## Question #5

[Algebra, 5 Points]

What is the sum of the following numbers

$p + q$, $q + r$, $r + s$, $s + p$

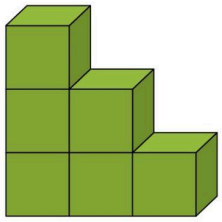
if the mean of p, q, r, and s is 27?

A) 248 B) 240 C) 232 D) 224 E) 216

## Question #6

[Geometry, 5 Points]

Kevin built stairs that are 3 cubes tall.
How many **more** cubes does he need to make the stairs 12 cubes high?



A) 72 B) 68 C) 65 D) 62 E) 58

## Question #7

[Number Theory, 5 Points]

How many two-digit positive integers have **exactly** one 7 as a digit?

A) 21 B) 20 C) 19 D) 18 E) 17

## Question #8

[Combinatorics, 5 Points]

In Linda's garden each plant has either "2 leaves and 1 flower" or "3 leaves". In total, the plants have 18 leaves.
How many different numbers of plants are possible?

A) 7 B) 6 C) 5 D) 4 E) 3

## Question #9

[Algebra, 5 Points]

What is the exact point at $\frac{3}{4}$ of the distance from $1\frac{1}{3}$ to $1\frac{3}{4}$?

A) $\frac{19}{12}$ B) $\frac{35}{24}$ C) $\frac{79}{48}$ D) $\frac{37}{24}$ E) $\frac{61}{48}$

## Question #10

. [Geometry, 5 Points]

The vertices of a triangle are (1, 1), (5, 4), and (3, 4).
What is the area of the triangle?

A) $\frac{3}{2}$ B) $\frac{5}{2}$ C) $\frac{7}{2}$ D) 3 E) 1

## Question #11

. [Number Theory, 5 Points]

If ACB and BCA are three-digit numbers and

$$A - B = 5$$

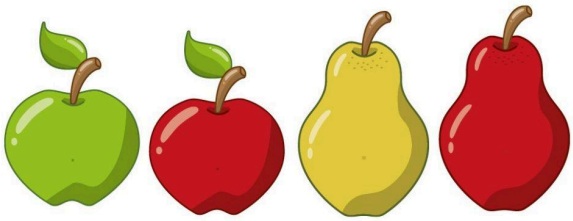
then, what is ACB − BCA?

A) 505 B) 495 C) 485 D) 475 E) 465

## Question #12

. [Combinatorics, 5 Points]

In a bag there are 4 green apples, 5 red apples, 8 yellow pears and 3 red pears. Linda randomly takes fruits out of the bag one by one.
How many fruits must she take out in order to be sure that she has **at least** one apple and one pear of the same color?



A) 14 B) 15 C) 17 D) 18 E) 19

## Question #13

. [Algebra, 7 Points]

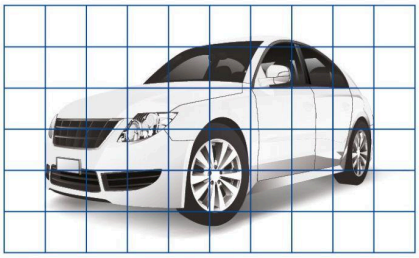
Doctor gives you 5 pills as a cold medicine and tells you to take one pill in every half an hour.
How long does it take to finish the pills?

A) $2\frac{1}{2}$ hours B) 2 hours C) $3\frac{1}{2}$ hours D) 3 hours E) $1\frac{1}{2}$ hours

## Question #14

. [Geometry, 5 Points]

What is the approximate percent of area of the car printed on the unit square grid?



A) 25% B) 33% C) 45% D) 55% E) 65%

## Question #15

. [Number Theory, 7 Points]

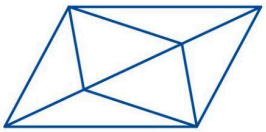
How many digits are there in the number $5^9 \times 4^5$?

A) 8 B) 9 C) 10 D) 11 E) 12

## Question #16

. [Combinatorics, 7 Points]

How many polygons of any size are there in the figure?



A) 33 B) 34 C) 35 D) 36 E) 38