ANSWERS: DIVISION M

SET #13

Olympiad 1	Olympiad 2	Olympiad 3	Olympiad 4	Olympiad 5
1A. 1,000,000	**2A.** 50	**3A.** 4	**4A.** 7	**5A.** 8
1B. 21	**2B.** 10	**3B.** 4	**4B.** 85	**5B.** $\frac{1}{45}$
1C. 15	**2C.** 108	**3C.** $\frac{12}{125}$	**4C.** 36	**5C.** 14
1D. 11	**2D.** 325	**3D.** 72	**4D.** 2	**5D.** 38
1E. 74	**2E.** $840	**3E.** a=6, b=2, c=3	**4E.** 25 sq units	**5E.** 300

SET #14

Olympiad 1	Olympiad 2	Olympiad 3	Olympiad 4	Olympiad 5
1A. 92	**2A.** .826	**3A.** 41	**4A.** 7	**5A.** 36
1B. 4	**2B.** 5	**3B.** 12	**4B.** $\frac{1}{3}$	**5B.** 23
1C. 39 sq mm	**2C.** 47	**3C.** $\frac{3}{5}$	**4C.** 9	**5C.** 56
1D. 5	**2D.** 3	**3D.** 82 units	**4D.** 27π sq cm	**5D.** 363
1E. $\frac{3}{8}$	**2E.** 25	**3E.** 108	**4E.** 48	**5E.** 7

SET #15

Olympiad 1	Olympiad 2	Olympiad 3	Olympiad 4	Olympiad 5
1A. 16	**2A.** 37, 73	**3A.** 11	**4A.** 4	**5A.** 9919
1B. 12	**2B.** 8	**3B.** 7	**4B.** $\frac{5}{7}$	**5B.** 47
1C. 720 sq mm	**2C.** 1000	**3C.** 19	**4C.** 12	**5C.** 7
1D. $125	**2D.** 165	**3D.** (3,10)	**4D.** 10 cm	**5D.** 54
1E. 5	**2E.** 11	**3E.** 43	**4E.** $\frac{3}{36}$	**5E.** 10π

SET #16

Olympiad 1	Olympiad 2	Olympiad 3	Olympiad 4	Olympiad 5
1A. 12	**2A.** Wednesday	**3A.** X=9, Y=3	**4A.** 21	**5A.** 100 miles
1B. 15	**2B.** 32 sq cm	**3B.** 10	**4B.** 10	**5B.** 2
1C. 1 & –11	**2C.** 61	**3C.** $\frac{2}{7}$	**4C.** 19,354	**5C.** –15
1D. 49	**2D.** 5	**3D.** 153	**4D.** 77	**5D.** 66
1E. 114	**2E.** $\frac{24}{5}$	**3E.** 4.8	**4E.** 126	**5E.** 19

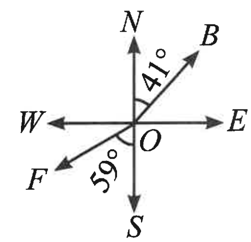
SET 15 SOLUTIONS

5C *Strategy: Find a pattern in the successive powers of 2 and of 3.*
$2^1 = \underline{2}$, $2^2 = \underline{4}$, $2^3 = \underline{8}$, $2^4 = 1\underline{6}$, $2^5 = 3\underline{2}$, $2^6 = 6\underline{4}$, $2^7 = 12\underline{8}$, $2^8 = 25\underline{6}$, and so on. The ones digits repeat in the pattern 2, 4, 8, 6 and then 2, 4, 8, 6, and so on. Then 2^4, 2^8, 2^{12}, and 2^{16} all have the same ones digit, 6. Similarly, 2^3, 2^7, 2^{11}, and 2^{15} all have the same ones digit, 8.

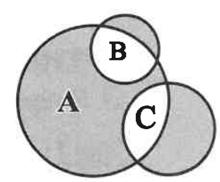
Repeat the process on powers of 3. The successive ones digits are 3, 9, 7, 1 and then 3, 9, 7, 1 again, and so on. Then 3^{10} has the same as the ones digit as 3^2, namely 9. Thus **the ones digit in $2^{15} + 3^{10}$** is the same as that of 8 + 9, which **is 7.**

> **FOLLOW-UPS:** *(1) What is the ones digit in the product of $2^{2012} \times 3^{2013} \times 5^{2014}$?* [0] *(2) How many consecutive zeros appear at the end of the product?* [2012]

5D *Strategy: Draw a picture.*
The angle through which the boat turns is $\angle BOF$. m$\angle BOE = 90 - 41 = 49$ and m$\angle WOF = 90 - 59 = 31$. To begin at a heading of B and finish at a heading of F, the boat must turn either $41 + 90 + 31 = 162°$ counterclockwise, or $49 + 90 + 59 = 198°$ clockwise. The lesser angle requires less time, and at 3° per second, **the least time required is** $162 \div 3 =$ **54 seconds.**



5E *Strategy: Find the total of the unshaded areas.*
The sum of the areas of the 3 circles, $4\pi + 9\pi + 16\pi = 29\pi$, includes each interior region in the picture. However, it includes regions B and C twice, since each is part of two circles. The sum of the areas of B and C is then $(29\pi - 17\pi) \div 2 = 6\pi$. The largest circle, whose area is 16π, consists of regions A, B, and C, so **the area of region A alone is** $16\pi - 6\pi =$ **10π.**



Set 16 Olympiad 1

1A METHOD 1: *Strategy: Use the distributive property.*
$2013 \times 10{,}001 = 2013 \times (10{,}000 + 1) = 20130000 + 2013$. There are no carries in the addition of the two addends, so the sum of the digits in the sum is the same as the sum of the digits in the two numbers. **The sum of the digits in the product is** 6 + 6 = **12.**

METHOD 2: *Strategy: Do the multiplication.*
$2013 \times 10{,}001 = 20{,}132{,}013$. The sum of the digits in the product is 12.

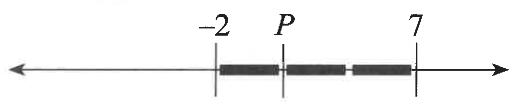
SET 16 SOLUTIONS

1B *<u>Strategy</u>: Consider the first 6 positive integers.*
The problem suggests that it doesn't matter which 6 consecutive integers are chosen, so choose small values, say, 1 through 6. (You may choose any set of 6 consecutive integers.) Divide each of the numbers 1, 2, 3, 4, 5, and 6 by 6 and get remainders 1, 2, 3, 4, 5, and 0. **The sum of the resulting 6 remainders is 15.**

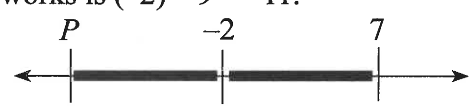
> **FOLLOW-UP:** *Ari lists the integers from 31 through 50, inclusive, and then crosses out one of them. He divides each of the remaining numbers by 20 and adds the remainders. The sum of the remainders is 177. Which number did Ari cross out?* [33]

1C METHOD 1: *<u>Strategy</u>: Draw a number line.*

<u>Case 1</u>: If P is between –2 and 7 and twice as far from 7 as from –2, divide the segment between them into 3 equal parts as shown below. $7 - (-2) = 9$, so each part is 3 units long. One number that works is $-2 + 3 = 1$.



<u>Case 2</u>: If P is to the left of –2 and twice as far from 7 as from –2, then –2 is halfway between P and 7. Since 7 is 9 units to the right of –2, P is 9 units to the left of –2. Another number that works is $(-2) - 9 = -11$.



Note that no other number can be to the right of 7, as it would then be closer to 7 than to –2. **The two integers are 1 and –11.**

METHOD 2: *<u>Strategy</u>: Use algebra.*
Let P represent the number to be found.

<u>Case 1</u>: If P is between –2 and 7, then $7 - P = 2(P - (-2))$. That simplifies to $7 - P = 2(P + 2)$. Multiplying $P + 2$ by 2 results in $7 - P = 2P + 4$. Adding P to each side of the equation results in $7 = 3P + 4$. Subtracting 4 from each side results in $3 = 3P$. Then $P = 1$.

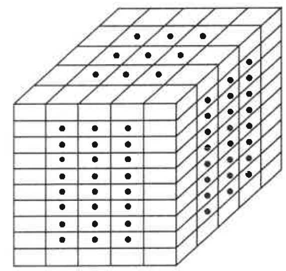
<u>Case 2</u>: However, if P is to the left of –2, then $7 - (-2) = -2 - P$. That simplifies to $9 = -2 - P$. Adding 2 to each side results in $11 = -P$. Multiplying both sides by –1 results in $P = -11$.

The two integers are 1 and –11.

1D *<u>Strategy</u>: Start with five 30s, and adjust.*
The minimal values for the first two numbers are 1 and 1. To maximize the median make the other three numbers as nearly equal as possible. The mean is 30, so the sum of all five numbers is 150. If the first two are 1 and 1, the sum of the other three is 148. $148 \div 3 = 49$ R1. The three numbers can be 49, 49, and 50. **The greatest possible value of the median is 49.**

Follow-Ups: *(1) What other set of 5 numbers would also satisfy the problem's conditions?* [1, 2, 49, 49, 49] *(2) The mean of the set of numbers 35, 78, 54, 112 and x is 73. What is the median of the set?* [78]

1E *Strategy: Examine each of the ten slices.*
Suppose the slices are made horizontally. The picture shows a view of all the slices. The top and bottom slices each have 9 blocks that have just one painted face. On each of the eight remaining slices there are 3 blocks with 1 painted face along each of the 4 horizontal sides. So, 3 blocks × 4 faces = 12 blocks painted per slice. **There is a total of** (2 × 9) + (8 × 12) = **114 blocks that have exactly one painted face.**



Follow-Ups: *(1) How many of the 250 blocks have no faces painted?* [72] *(2) How many have exactly 3 faces painted?* [8] *(3) Suppose the original cube, after painting, is sliced into 25 pieces, each 10 × 10 × 0.4 and then each of these pieces is cut into 1 × 1 × 0.4 blocks. How many of these 2500 blocks have exactly 3 faces painted red?* [8]

Olympiad 2

2A METHOD 1: *Strategy: Cast out weeks.*
After August 1st, there are 30 more days in August. There are 30 additional days in September and 25 more to October 25th. That is a total of 85 days. 85 ÷ 7 = 12, R1. Then October 25 is 1 day later in the week than August 1. October 25, 2018 is a Thursday, so **August 1, 2018 is Wednesday.**

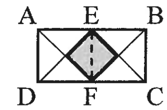
METHOD 2: *Strategy: Count backward.*
October 25, 2018 is a Thursday. Then October 18,11,4, September 27, 20,13, 6, August 30, 23, 16, 9, and 2 are also Thursdays. August 1, 2018 is a Wednesday.

METHOD 3: *Strategy: Count forward.*
August 1 is the same day of the week as August 8, 15, 22, 29, September 5, 12, 19, 26, October 3, 10, 17, and 24. October 25 is a Thursday, so August 1, 2018 is a Wednesday.

Follow-Ups: *February 5, 2012 was a Sunday. On what day of the week is February 5, 2018?* [Monday]

SET 16 SOLUTIONS

2B **METHOD 1:** *Strategy: Split the region into more familiar shapes.*



Draw $\overline{EF}$ to split the rectangle into 2 congruent squares. One-fourth of each square is shaded, and putting the squares together, one-fourth of rectangle $ABCD$ is shaded. The area of $ABCD$ is 128 sq cm, so **the area of the shaded region is 32 sq cm.**

METHOD 2: *Strategy: Draw a useful line segment.*
Since $AE = EB = BC = CF = FD = DA = 8$, all acute angles in the figure measure 45° and all other angles are right angles. Draw $\overline{EF}$, which is also 8. Rectangle $ABCD$ is now divided into 8 congruent isosceles right triangles. The area of $ABCD$ is 128 sq cm, so the area of each of the smaller 8 triangles is 16 sq cm. The area of the shaded square, consisting of two such triangles, is 32 sq cm.

> ***Follow-Ups:*** *(1) Suppose in the given problem, AB = 40 cm and BC = 7 cm. What is the area of the shaded region?* [70 sq cm] *(2) Suppose in the given problem, AB = x cm and BC = y cm. What is the area of the shaded region in terms of x and y?* [$\frac{xy}{4}$ sq cm]

2C *Strategy: Start with the most restrictive condition.*
There are fewer 2-digit perfect squares than 2-digit primes, so start with the squares.

$P + 3$	**16**	25	36	49	**64**	81
P	**13**	22	33	46	**61**	78
Is P prime?	**yes**	no	no	no	**yes**	no
$P + 6$	**19**				**67**	
Is $P = 6$ prime?	**yes**				**yes**	

19 and 67 are two-digit primes. However, 19 is not the next greater prime after 13; 17 is also prime. There are no primes between 61 and 67. **P is 61.**

2D **METHOD 1:** *Strategy: Simplify the problem by assuming the train is not moving.*
The boy travels 3 mph faster than the train. Suppose the train is not moving and the boy travels at 3 mph. He will reach the front of the train in the same amount of time as he would in the given problem. Traveling at 3 mph is equivalent to traveling 1 mile in 20 minutes ($\frac{1}{3}$ of an hour), and thus $\frac{1}{4}$ of a mile in 5 minutes. Therefore, **M = 5.**

SET 16 SOLUTIONS

METHOD 2: <u>Strategy</u>: *Make a chart*

Using the information given, the train's speed is $\frac{8}{60}$ of a mile every minute, and the boy's speed is $\frac{11}{60}$ of a mile every minute, create the following chart:

Distances	At 1 minute	At 2 minutes	At 3 minutes	At 4 minutes	At 5 minutes
Train	$\frac{8}{60}$	$\frac{16}{60}$	$\frac{24}{60}$	$\frac{32}{60}$	$\frac{40}{60}$
Boy	$\frac{11}{60}$	$\frac{22}{60}$	$\frac{33}{60}$	$\frac{44}{60}$	$\frac{55}{60}$
From rear of train to boy	$\frac{3}{60}$	$\frac{6}{60}$	$\frac{9}{60}$	$\frac{12}{60}$	$\frac{15}{60}$

Since the train is $\frac{1}{4}$ of a mile long the distance between the boy and the rear of the train has to be $\frac{1}{4} = \frac{15}{60}$ of a mile. That occurs at 5 minutes.

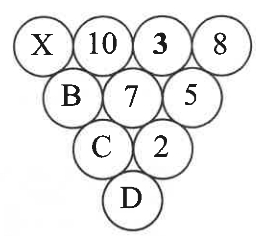
> **Follow-Up**: *Suppose the train travels at 12 mph and the boy starts at the front of the train and travels at 8 mph toward the rear of the train. How long will it take him to reach the rear of the train?* [45 seconds]

2E <u>Strategy</u>: *Minimize the numerator and maximize the denominator.*

Divide: $\frac{a}{b} \div \frac{6}{25} = \frac{a}{b} \times \frac{25}{6}$. Because the result is a whole number, then 6 is a factor of a and b is a factor of 25. Likewise, $\frac{a}{b} \div \frac{8}{15} = \frac{a}{b} \times \frac{15}{8}$. Because this result is a whole number, then 8 is a factor of a and b is a factor of 15. Since 6 and 8 are both factors of a, the least possible value of a is 24. Also, since b is a factor of both 25 and 15, the greatest possible value of b is 5. **The least possible value of the fraction $\frac{a}{b}$ is $\frac{24}{5}$.**

Olympiad 3

3A <u>Strategy</u>: *Use the 10 and 7 to find Y.*



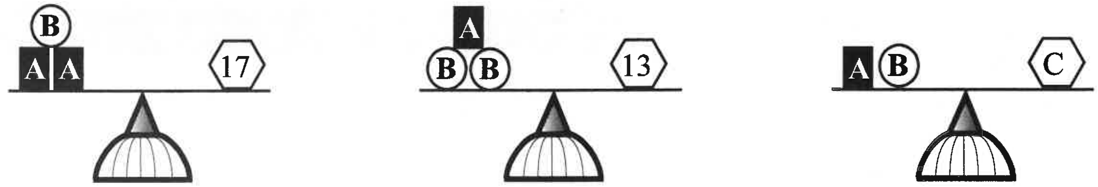
Because 10 – Y = 7, Y is 3. Then 8 – 3 = 5 and 7 – 5 = 2. Fill in 5 and 2.

The remaining circles contain 1, 4, 6, and 9 in some order: because C – 2 = D, then C is 6 and D is 4. Fill in 6 and 4.

Since $|7 - B| = 6$, B is 1 or 13. Since 13 is not in the set, B is 1. Therefore, X is 10 – 1 = 9. Thus **Y = 3 and X = 9.**

SET 16 SOLUTIONS

3B *Strategy: Represent the given information in algebraic form.*
The first 2 diagrams show that $2A + B = 17$ and $A + 2B = 13$. The third diagram shows that $A + B = C$. The question asks for the value of $A + B$.



METHOD 1: Add the equations $2A + B = 17$ and $A + 2B = 13$ to get $3A + 3B = 30$. Divide both sides of $3A + 3B = 30$ by 3 to get $A + B = 10$. Because $A + B = C$, **<u>C is 10</u>.**

METHOD 2: Since $2A + B = 17$ and $A + 2B = 13$, the value of A is 4 more than that of B. Because $2A + B = 17$, $2A + A = 21$. Then $3A = 21$ and <u>A is 7</u>.

Now find B and then C: Since $2A + B = 17$, $14 + B = 17$ and <u>B is 3</u>. These values also check in $A + 2B = 13$. Since $A + B = 7 + 3$, <u>C is 10</u>.

FOLLOW UPS: (1) Find the value of $a + b + c$ in the system of equations: $a + b + 5c = 23$; $a + 5b + c = 19$; $5a + b + c = 35$. [11] *(2) Find the values of x, y, and z: $x + y - z = -2$; $x - y + z = 5$; $-x + y + z = -4$.* [$x = \frac{3}{2}$, $y = -3$, $z = \frac{1}{2}$.]

3C *Strategy: Seat the boys one at a time.*
Let the first boy pick any of the 8 available chairs. If the second boy is to sit in a chair next to the first boy, then he has only two choices out of the seven unoccupied chairs. So **the probability that the two boys are seated next to each other is $\frac{2}{7}$.** The girls may sit in any order without affecting the outcome.

FOLLOW-UP: Suppose an empty chair is between the 2 boys at the table. What is the probability that one particular girl is <u>not</u> seated next to either boy? [$\frac{3}{6}$ or $\frac{1}{2}$]

3D **METHOD 1:** *Strategy: Look for a pattern in the number of new trees each year.*
Each year the farmer plants 4 more trees than the previous year.

Year	1	2	3	4	…	9
Number of new trees planted	1	5	9	13	…	?
Total trees to date	1	6	15	28	…	?

3	3	3	3	3
3	2	2	2	3
3	2	1	2	3

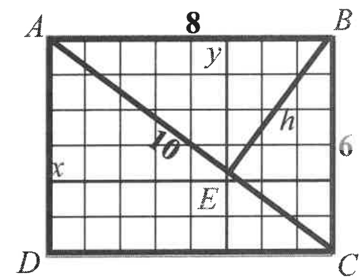
The total number of trees is then $1 + 5 + 9 + 13 + 17 + 21 + 25 + 29 + 33 = 153$. Or, since the numbers in the second row of the table are equally spaced, their sum equals the median multiplied by the number of entries: $17 \times 9 = 153$. **By the end of the Year 9, he had planted 153 trees in all.**

SET 16 SOLUTIONS

METHOD 2: Strategy: *Find the dimensions of the rectangle at the end of each year.*
Examine the diagram for each of the first three years. Starting with Year 2, each year he adds one more row and two more columns. Thus, the total number of trees at the end of two years is arrayed in 2 rows of 3 columns each for 6 trees, at the end of three years in 3 rows of 5 columns each for 15 trees, and at the end of four years, there were 4 rows of 7 columns each for a total of 28 trees (as shown in the table above). Following the pattern, at the end of nine years he had planted 9 rows of 17 columns each for a total of 153 trees.

3E Strategy: *Express the area of triangle ABC in two ways.*
Graph and label the figure, as shown. Counting boxes, $AB = 8$ and BC = 6. Express the area of triangle ABC two different ways: $\frac{1}{2} \times 6 \times 8$ and $\frac{1}{2} \times 10 \times h$. Then equate them since they represent the same area: $24 = 5 \times h$.

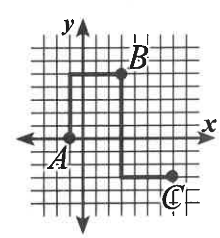
The length of $\overline{BE}$ is 4.8.



Follow-Up: The lengths of the legs of a right triangle are represented by a units and b units, the hypotenuse by c units, and the altitude to the hypotenuse by h units. Express the value of h in terms of a, b, and c. [$h = \frac{ab}{c}$]

Olympiad 4

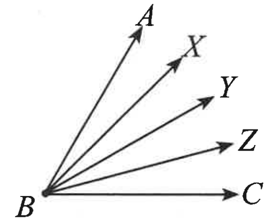
4A **METHOD 1:** Strategy: *Draw the diagram.*
The shortest path occurs when each move is toward the goal. One possible path is shown. Count to find that **the shortest path is 21 units long.**



METHOD 2: Strategy: *Determine horizontal and vertical distances separately.*
Horizontally, the distance from $A(-1, 0)$ to $B(3, 5)$ is 4 units, and then on to $C(7, -3)$ is also 4 units for a total of 8 units. Vertically, the distance from $A(-1, 0)$ to $B(3, 5)$ is 5 units, and then on to $C(7, -3)$ is 8 units for a total of 13 units. The length of the shortest path is $8 + 13 = 21$ units long.

SET 16 SOLUTIONS

4B *Strategy: Count in an organized way.*



Consider each individual angle and each combination of adjacent individual angles.

One individual angle:	$\angle ABX$, $\angle XBY$, $\angle YBZ$, $\angle ZBC$.
Two individual angles:	$\angle ABY$, $\angle XBZ$, $\angle YBC$
Three individual angles:	$\angle ABZ$, $\angle XBC$
Four individual angles:	$\angle ABC$

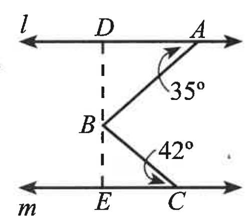
Altogether, $4 + 3 + 2 + 1 =$ **10 acute angles are in the diagram.**

> **FOLLOW UPS:** *(1) A triangle is formed by connecting 3 vertices of a given pentagon. In how many ways can this be done?* [10] *(2) Why is this question equivalent to problem 4B?* [Consider the vertices that are not used.] *(3) How many different committees of 5 people can be chosen from a group of 7 people?* [21]

4C *Strategy: Minimize the number of ushers.*

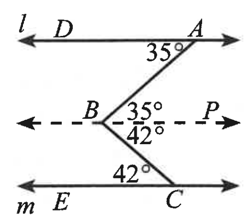
Group each 30 fans with 1 usher to form groups of 31. Then the 20,000 people are divided into 645 groups of 31 each, with 5 people left over. Those 5 people must contain at least 1 usher and at most 4 fans. There must be at least $645 + 1 = 646$ ushers. **There are at most** $20{,}000 - 646$ $=$ **19,354 fans that can be in attendance.**

4D **METHOD 2:** *Strategy: Draw a useful line segment.*



Through B draw a line segment ($\overline{DE}$) perpendicular to both line l and line m as shown. The acute angles in a right triangle are complementary. In right ΔDBA, $\angle DBA$ contains $90 - 35 = 55°$. Similarly, in right $\Delta\, EBC$, $\angle EBC$ contains $90 - 42 = 48°$. $\angle DBE$ is a straight angle and it equals 180°, **so $\angle$ABC** $= 180 - 55 - 48 =$ **77°.**

METHOD 2: *Strategy: Draw a different useful line segment.*



Through B draw line DP parallel to both line l and line m as shown. If a transversal cuts two parallel lines, the alternate interior angles are congruent. Then $\angle DAB$ contains the same number of degrees, 35, as $\angle ABP$ and $\angle PBC$ contains the same number of degrees, 42, as $\angle BCE$. Therefore $\angle$ABC contains $35 + 42 = 77°$.

SET 16 SOLUTIONS

4E *Strategy: Convert the given fractions into decimals.*
Counting the decimals is an easier process than counting fractions. Write the given fractions in decimal form using 3 decimal digits: $\frac{1}{4} = .250$ and $\frac{3}{8} = .375$. From .001 through .375, there are 375 three-place decimals, but 249 of them (.001 through .249) are not in the desired range. Thus there are $375 - 249 = 126$ decimals in the range that can be expressed using exactly three decimal places, and each of them is equivalent to a unique fraction in lowest terms. **There are 126 fractions between $\frac{1}{4}$ and $\frac{3}{8}$ inclusive that can be exactly represented using three-digit decimals.**

> ***Follow-Up:*** *There are exactly 13 fractions in lowest terms between $\frac{1}{5}$ and N, inclusive, that can be represented as a decimal numeral with exactly two decimal digits. $N > \frac{1}{5}$. Find N in lowest terms.* [$\frac{8}{25}$]

Olympiad 5

5A METHOD 1: *Strategy: Make a table comparing the faulty and actual distances.*

Odometer Reading in Miles	4.6	9.2	…	46	92
Actual Miles Traveled	5	10	…	50	100

Acton and Bywater are 100 miles apart.

METHOD 2: *Strategy: Use proportional reasoning*
The ratio of registered miles to actual miles is always 4.6 to 5. Since 4.6 must be multiplied by 20 to get 92, multiply 5 by 20. Acton and Bywater are 100 miles apart.

METHOD 3: *Strategy: Use algebra.*
If x is the actual distance traveled, then: $\frac{4.6}{5} = \frac{92}{x}$
Cross-multiply: $4.6x = (5)(92)$
Simplify: $4.6x = 460$
Divide each side of the equation by 4.6: $x = 100$
Therefore Acton and Bywater are 100 miles apart.

5B *Strategy: Look for a pattern in the partial sums.*
Write the first term, the sum of the first two terms, the sum of the first three terms, and so on, to form a new sequence: 2, –1, –3, 0, then 2, –1, –3, 0, then 2, –1, –3, 0, … These cumulative sums repeat in blocks of 4. 2012 is a multiple of 4, so the 2012th sum is 0. The 2013th sum is therefore 2. **The sum of the first 2013 terms of the sequence is 2.**

> ***Follow-Ups:*** *(1) Suppose today is Wednesday. What day of the week is 1000 days from today?* [Tuesday] *(2) The first four terms of the series $2 - 3 - x + 3 + \ldots$ repeat endlessly. Find the value of x that will make the sum of the first 47 terms equal –87.* [9]

SET 16 SOLUTIONS

5C **METHOD 1:** *Strategy: Select a convenient value for x.*

There are infinitely many pairs of values of x and y that satisfy the given equation. Select any convenient value of y and use it to solve for x. For example, suppose y is 0. Then $5x - 2y = 30$ becomes $5x - 0 = 30$ and $x = 6$. Then $y - \frac{5}{2}x$ becomes $(0) - \frac{5}{2}(6) = 0 - 15$. Thus, $\mathbf{y - \frac{5}{2}x = -15}$.

Check by using a few other values for x or y. The result will always be –15.

METHOD 2: *Strategy: Use algebraic procedures to transform the equation.*

Start with the given equation:	$5x - 2y = 30$
Multiply both sides of equation by –1:	$-1(5x - 2y) = -30$
Distribute the negative sign on the left side of equation:	$-5x + 2y = -30$
Rearrange the terms on the left side of equation:	$2y - 5x = -30$
Divide each term by 2:	$y - \frac{5}{2}x = -15$:

5D *Strategy: Use the meaning of percent.*

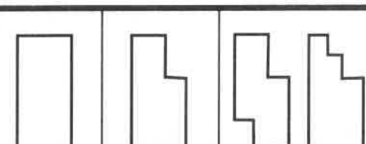
The fraction of all adults starting a new business last year was $\frac{1}{N}$ and this year it was $\frac{1}{55}$. An increase of 20% means that the new rate is 120% of the old rate, or 1.2 times the old rate.

The old rate multiplied by 1.2 is the new rate:	$(1.2)\frac{1}{N} = \frac{1}{55}$
Multiply $\frac{1}{N}$ by 1.2:	$\frac{1.2}{N} = \frac{1}{55}$
Cross-multiply:	$(N)(1) = (1.2)(55)$
Simplify:	$N = 66$

The equation can be solved in several other ways but the result will always be $\mathbf{N = 66}$.

5E *Strategy: Start with simple cases and look for a pattern.*

Start with a rectangle which has 4 "inside" corners and 0 "outside" corners. Then add one corner at a time by cutting right-angled pieces from it.

Sketch				...	
Number of inside corners	4	5	6	...	23
Number of outside corners	0	1	2	...	*P*

In each case there are 4 more inside corners than outside corners. In the complete floor plan, there are 23 inside corners and therefore 19 outside corners. $\mathbf{P = 19}$.