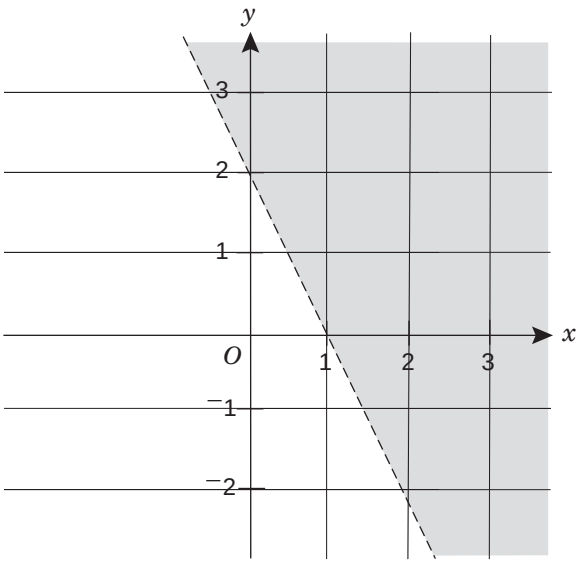
FOR GRADE 9 MATHEMATICS

DIRECTIONS: This section provides sample mathematics problems for the Grade 9 test forms. These problems are based on material included in the New York City curriculum for Grade 8. (The Grade 8 problems on sample forms A and B cover mathematics material through Grade 7.) General directions for how to answer math questions are located on pages 48 and 84. There is no sample answer sheet for this section; mark your answers directly on this page or on a separate piece of paper.

1. In 1960, the number of tons of solid waste produced by a city was 75 million. In 1990, the number of tons was 180 million. By what percentage did the solid waste tonnage increase from 1960 to 1990?

A. 70%
B. 75%
C. 105%
D. 140%
E. 240%

2.



Which inequality has the shaded region in the diagram above as its graph?

F. $y \leq -2x + 2$
G. $y < -2x + 2$
H. $y \geq -2x + 2$
J. $y > -2x + 2$
K. $y = -2x + 2$

3. Jessenia usually earns $25 each week. Last week, she received an extra $20 in bonus. What percent of her usual weekly income was her total income last week?

A. 10%
B. 45%
C. 80%
D. 180%
E. 225%

4. Let M′ = (12, 12) and N′ = (24, 12). If $\overline{M'N'}$ is the dilated image of $\overline{MN}$, where M = (5, 5), what are the coordinates of point N?

F. (17, 7)
G. (10, 5)
H. (7.5, 5)
J. (0.2, 0.1)
K. (0.1, 0.2)

5. n is an integer smaller than -2. What is the range of possible values of $\frac{1}{n^2}$?

A. $\frac{1}{n^2} < -4$

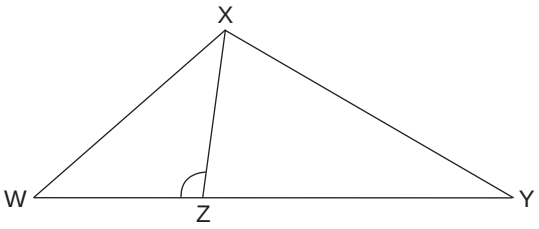
B. $\frac{1}{n^2} > 4$

C. $0 < \frac{1}{n^2} < \frac{1}{4}$

D. $-\frac{1}{4} < \frac{1}{n^2} < 0$

E. $-\frac{1}{2} < \frac{1}{n^2} < \frac{1}{2}$

6.



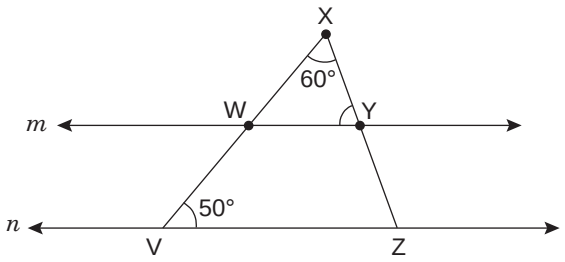
$\overline{WZY}$ is a straight line segment and $\triangle XWZ$ is congruent to $\triangle YXZ$. What can one conclude about $\angle XZW$? (The figure is not drawn to scale.)

F. $\angle XZW$ is a right angle.
G. $\angle XZW$ is larger than $\angle XZY$.
H. $\angle XZW$ is smaller than $\angle XZY$.
J. $\angle XZW$ has the same measure as $\angle XYZ$.
K. $\angle XZW$ has the same measure as $\angle YXZ$.

7. Simplify $\dfrac{e^2 \cdot e^3}{e^6}$

A. 1
B. e^0
C. e^{-1}
D. $e^{\frac{5}{6}}$
E. e

8.

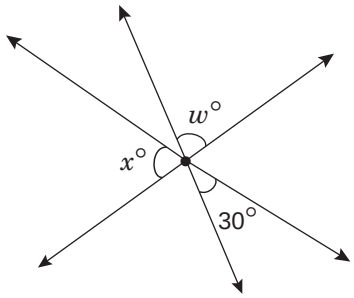


line m // line n

$\overline{VWX}$ is a straight line segment, and W and Y are points on line m. What is the measure of $\angle XYW$?

F. 40°
G. 50°
H. 60°
J. 70°
K. 80°

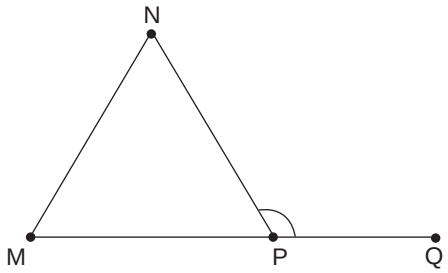
9.



In the figure above, three lines intersect at a point. What is the value of w in terms of x?

A. $150 - x$
B. $165 - x$
C. $180 - x$
D. $150 - 2x$
E. $30 + x$

10.



In this figure, MN = NP = PM and $\overline{MPQ}$ is a straight line segment. What is the measure of $\angle NPQ$?

F. 60°
G. 90°
H. 100°
J. 120°
K. 150°

11. Let P = (2, 3). First, translate P one unit to the right and call the image R. Next, reflect R over the y-axis and call the image S. Finally, rotate S 90° clockwise about the origin and call the image T. What are the coordinates of T?

A. $(-3, -3)$
B. $(-2, -3)$
C. $(-2, 3)$
D. $(3, -3)$
E. $(3, 3)$

12. The radius of circle C_1 is R, and that of circle C_2 is r. The area of C_1 is twice that of C_2. What is R in terms of r?

F. $\frac{1}{2}r$

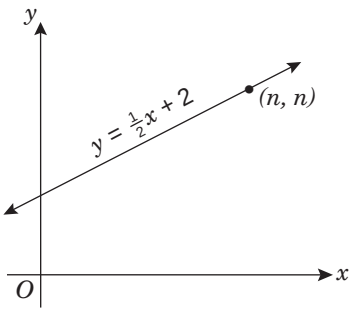
G. $\frac{1}{\sqrt{2}}r$

H. $\sqrt{2}\,r$

J. $2r$

K. $4r$

13.



What is the value of n in the figure above?

A. 1

B. 2

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

D. 3

E. 4

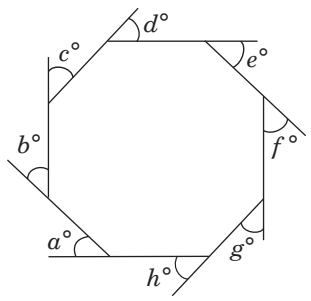
14.

$$x^2 = \text{P}$$
$$x^2 \bullet x = \text{Q}$$
$$x^2 \div x = \text{R}$$
$$x^2 + x = \text{S}$$
$$x^2 - x = \text{T}$$

If $x = {}^{-}6$ in the equations above, which letter has the greatest value?

F. P
G. Q
H. R
J. S
K. T

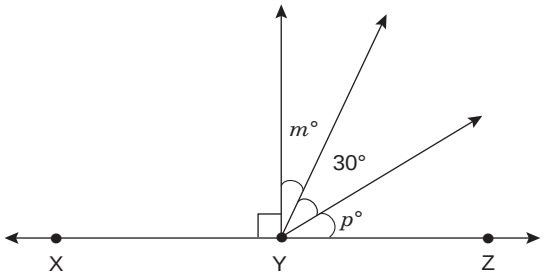
15.



The figure above is a regular octagon. What is the sum of the measures of the exterior angles $(a + b + c + d + e + f + g + h)$?

A. 30
B. 45
C. 135
D. 360
E. 1,080

16.



In the figure above, Y is a point on line $\overleftrightarrow{XZ}$. What is the value of $m + p$?

F. 45
G. 60
H. 75
J. 90
K. 120

17. A jar contains exactly 6 balls: 5 red and 1 blue. If 5 balls are drawn from the jar at random and without replacement, what is the probability that they are all red?

A. $\frac{1}{6}$

B. $\frac{1}{5}$

C. $\frac{5}{11}$

D. $\frac{2}{3}$

E. $\frac{5}{6}$

FOR GRADE 9 MATHEMATICS

1. (**D**) The base for the percentage is the weight for the first year (1960), 75 million tons. The increase from the first year to the ending year (1990) is 105 million tons (180 million − 75 million).

$\frac{105 \text{ million}}{75 \text{ million}} = 1.4 \times 100 = 140\%$, which is Option D.

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2. (**J**) The equation whose graph is the dashed line is

$$y = {}^{-}2x + 2.$$

Therefore, the region above the line is the graph of the inequality

$$y > {}^{-}2x + 2.$$

The dashed line means that the line does not belong to the shaded region. So the shaded region is the graph of the inequality $y > {}^{-}2x + 2$ and not that of $y \geq {}^{-}2x + 2$.

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3. (**D**) Jessenia's total income for last week was \$25 + \$20 = \$45. Divide her income last week by her usual weekly income to determine the ratio between them, and then multiply by 100 to obtain the percent.

$\frac{45}{25} \times 100 = 1.8 \times 100 = 180\%$

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4. (**G**) First, we need to find the scale factor d using M and M′.

$5d = 12$

$d = \frac{12}{5}$

If N = (x, y) and N′ = (24, 12), then:

$\frac{12}{5}x = 24$

$x = 24\left(\frac{5}{12}\right) = 10$

and $\frac{12}{5}y = 12$

$y = 12\left(\frac{5}{12}\right) = 5$

So, N = (10, 5).

5. (**C**) Although n is a negative number, its square is positive. Therefore, $n^2 > 4$. From this, we obtain $\frac{1}{n^2} < \frac{1}{4}$. (Note that in taking reciprocals, the inequality is reversed.) In addition, we know that $\frac{1}{n^2}$ is a positive number.

So $0 < \frac{1}{n^2} < \frac{1}{4}$ is the range of all possible values.

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6. (**F**) Because triangles XWZ and YXZ are congruent, the corresponding angles WZX and XZY are equal. We know that $\overline{WZY}$ is a straight line segment, so angles WZX and XZY are supplementary (the sum of their measures is 180°). Because the angles are equal, the measure of each is equal to 90°. So Option F is correct, and Options G and H are incorrect. Options J and K are not correct because angles XYZ and YXZ correspond to angles WXZ and XWZ, respectively. Because angle WZX is a right angle, angles XWZ and WXZ must each be smaller than angle WZX. So angle WZX cannot have the same measure as either angle XYZ or angle YXZ. Note that the diagram is deliberately not drawn to scale, so that the answer is not given away.

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7. (**C**) $$\frac{e^2 \cdot e^3}{e^6} = \frac{e^5}{e^6} = e^{5-6} = e^{-1}$$

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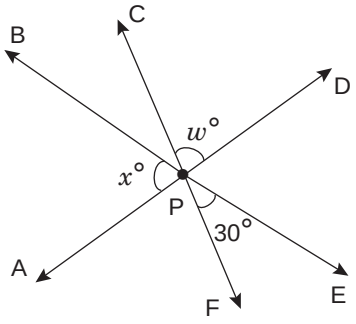
8. (**J**) Because m and n are parallel lines, the two corresponding angles XWY and XVZ are equal. The measure of angle XWY is thus 50°. This means that the measure of angle XYW must be 180° − 60° − 50° = 70°.

FOR GRADE 9 MATHEMATICS

9. (**A**) Label the diagram as follows:



Note that ∠BPC = ∠EPF. Therefore, the measure of ∠BPC is 30°. Since $\overleftrightarrow{APD}$ is a straight line, the measures of ∠APB, ∠BPC, and ∠CPD add up to 180°. Therefore:

$$x + 30 + w = 180$$
$$x + w = 180 - 30 = 150$$
$$w = 150 - x$$

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10. (**J**) The sides of the triangle are equal in length, so the triangle is equilateral. The angles of an equilateral triangle are all equal to 60°. $\overline{MPQ}$ is a straight line segment, so angle MPN and angle NPQ are supplementary. So the measure of angle NPQ is 180° − 60° = 120°.

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11. (**E**) Translating P one unit to the right will increase the value of x by 1, so R = (3, 3). Reflecting R over the y-axis will keep the value of y the same, but change the sign on the value of x, so S = (⁻3, 3). Finally, rotating S 90° clockwise about the origin will put the point back in the first quadrant and make T = (3, 3).

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12. (**H**) The area of C_1 is πR^2 and that of C_2 is πr^2. We know that $\pi R^2 = 2\pi r^2$. Simplifying, we obtain $R^2 = 2r^2$. Taking the square root of each side, we obtain $R = \sqrt{2}\ r$.

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13. (**E**) The point (n, n) is on the line and so must satisfy the equation. Substitute $x = n$ and $y = n$ and one obtains $n = \frac{1}{2}n + 2$, or $\frac{1}{2}n = 2$; therefore, $n = 4$.

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14. (**K**) We are given that $x = {}^-6$, so we can immediately eliminate options Q and R. Q simplifies to x^3, which would result in a negative solution. Similarly, R simplifies to x, which would also result in a negative solution. Of the remaining options, the value of P would be between S and T, so we only need to evaluate S and T to find which is greater.

$S = x^2 + x = ({}^-6)^2 + ({}^-6) = 36 - 6 = 30$

$T = x^2 - x = ({}^-6)^2 - ({}^-6) = 36 + 6 = 42$

So, T has the greatest value.

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15. (**D**) The sum of the interior angles of an octagon is (2 • 8 − 4) right angles, that is, 1,080°. Because all eight interior angles are equal, the measure of each interior angle is 1,080° ÷ 8 = 135°. Therefore, each exterior angle is 180° − 135° = 45°. The sum of all eight exterior angles is then 8 • 45° = 360°.

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16. (**G**) $\overleftrightarrow{XYZ}$ is a straight line. So

$$90 + m + 30 + p = 180$$
$$m + p + 120 = 180$$
$$m + p = 60.$$

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17. (**A**) List all the possibilities of drawing 5 balls out of 6 without replacement. Let R stand for a red ball and B stand for a blue ball. There are only 6 possibilities: RRRRR, RRRRB, RRRBR, RRBRR, RBRRR, BRRRR. Therefore, the probability that the 5 balls drawn are all red is $\frac{1}{6}$.

Answer Key for Grade 9 Mathematics

1. D	6. F	10. J	14. K
2. J	7. C	11. E	15. D
3. D	8. J	12. H	16. G
4. G	9. A	13. E	17. A
5. C			