CHAPTER

# 3 Math Pretest

The pretest contains questions similar to those found on the SAT. Take the pretest to familiarize yourself with the types of questions you will be preparing yourself for as you study this book.

.

Do not time yourself on the pretest. Solve each question as best you can. When you are finished with the test, review the answers and explanations that immediately follow the test. Make note of the kinds of errors you made and focus on these problems while studying the rest of this book.

## LEARNINGEXPRESS ANSWER SHEET

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | a | b | c | d | e | **6.** | a | b | c | d | e | **11.** | a | b | c | d | e |
| **2.** | a | b | c | d | e | **7.** | a | b | c | d | e | **12.** | a | b | c | d | e |
| **3.** | a | b | c | d | e | **8.** | a | b | c | d | e | **13.** | a | b | c | d | e |
| **4.** | a | b | c | d | e | **9.** | a | b | c | d | e | **14.** | a | b | c | d | e |
| **5.** | a | b | c | d | e | **10.** | a | b | c | d | e | **15.** | a | b | c | d | e |

**16.** **17.** **18.** **19.** **20.**

**21.** **22.** **23.** **24.** **25.**

**26.** **27.** **28.** **29.** **30.**

**1.** If $w = \frac{1}{8}$, then $w^{\frac{2}{3}} = ?$

**a.** $\frac{1}{2}$

**b.** $\frac{1}{4}$

**c.** $\frac{1}{8}$

**d.** $\frac{1}{12}$

**e.** $\frac{1}{64}$

**2.** Ben is three times as old as Samantha, who is two years older than half of Michele's age. If Michele is 12, how old is Ben?

**a.** 8
**b.** 18
**c.** 20
**d.** 24
**e.** 36

**3.** The expression $x^2 - 8x + 12$ is equal to 0 when $x = 2$ and when $x = ?$

**a.** –12
**b.** –6
**c.** –2
**d.** 4
**e.** 6

**4.** Mia ran 0.60 km on Saturday, 0.75 km on Sunday, and 1.4 km on Monday. How many km did she run in total?

**a.** $1\frac{1}{5}$ km

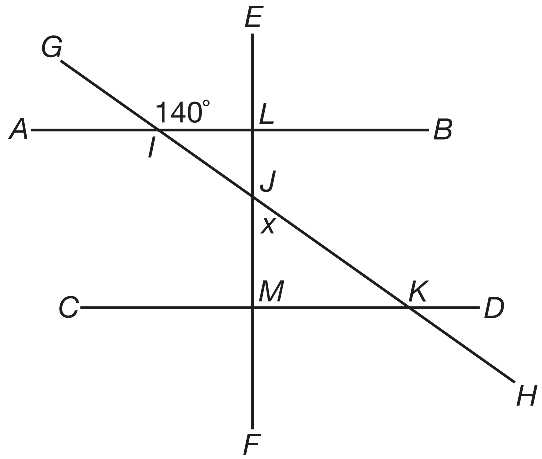
**b.** $1\frac{3}{4}$ km

**c.** $2\frac{1}{4}$ km

**d.** $2\frac{3}{4}$ km

**e.** $3\frac{1}{2}$ km

**5.**




In the diagram above, line *AB* is parallel to line *CD*, and line *EF* is perpendicular to line *CD*. What is the measure of angle *x*?

**a.** 40 degrees
**b.** 45 degrees
**c.** 50 degrees
**d.** 60 degrees
**e.** 80 degrees

**6.** The area of circle *A* is $6.25\pi$ in$^2$. If the radius of the circle is doubled, what is the new area of circle *A*?

**a.** $5\pi$ in$^2$
**b.** $12.5\pi$ in$^2$
**c.** $25\pi$ in$^2$
**d.** $39.0625\pi$ in$^2$
**e.** $156.25\pi$ in$^2$

**7.** David draws a line that is 13 units long. If (–4,1) is one endpoint of the line, which of the following could be the other endpoint?

**a.** (1,13)
**b.** (9,14)
**c.** (3,7)
**d.** (5,12)
**e.** (13,13)

**8.** The expression $(\frac{a^2}{b^3})(\frac{a^{-2}}{b^{-3}}) = ?$

**a.** 0

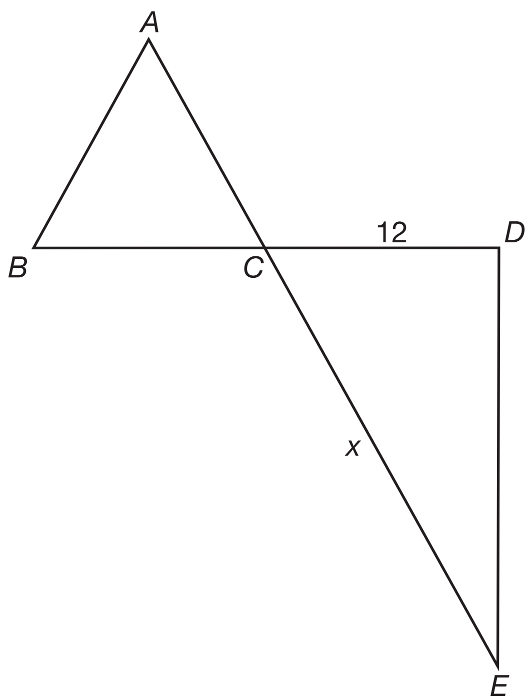
**b.** 1

**c.** $(\frac{a^{-4}}{b^{-9}})$

**d.** $(\frac{b^9}{a^4})$

**e.** $b^{-9}$

**9.**



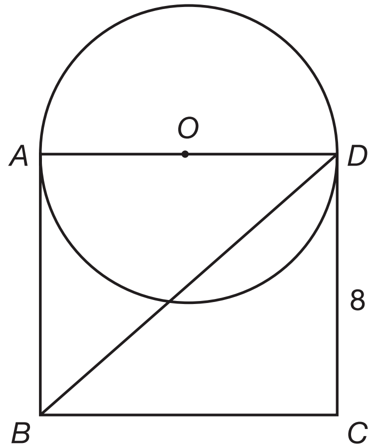

If triangle *ABC* in the figure above is an equilateral triangle and *D* is a right angle, find the value of *x*.

**a.** $6\sqrt{3}$
**b.** $8\sqrt{3}$
**c.** $12\sqrt{2}$
**d.** 13
**e.** 24

**10.** If 10% of $x$ is equal to 25% of $y$, and $y = 16$, what is the value of $x$?

**a.** 4
**b.** 6.4
**c.** 24
**d.** 40
**e.** 64

**11.**




Triangle *BDC*, shown above, has an area of 48 square units. If *ABCD* is a rectangle, what is the area of the circle in square units?

**a.** $6\pi$ square units
**b.** $12\pi$ square units
**c.** $24\pi$ square units
**d.** $30\pi$ square units
**e.** $36\pi$ square units

**12.** If the diagonal of a square measures $16\sqrt{2}$ cm, what is the area of the square?

**a.** $32\sqrt{2}$ cm$^2$
**b.** $64\sqrt{2}$ cm$^2$
**c.** 128 cm$^2$
**d.** 256 cm$^2$
**e.** 512 cm$^2$

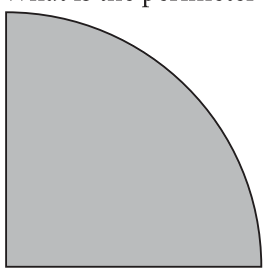
**13.** If $m > n$, which of the following must be true?

**a.** $\frac{m}{2} > \frac{n}{2}$
**b.** $m^2 > n^2$
**c.** $mn > 0$
**d.** $|m| > |n|$
**e.** $mn > -mn$

**14.** Every 3 minutes, 4 liters of water are poured into a 2,000-liter tank. After 2 hours, what percent of the tank is full?

**a.** 0.4%
**b.** 4%
**c.** 8%
**d.** 12%
**e.** 16%

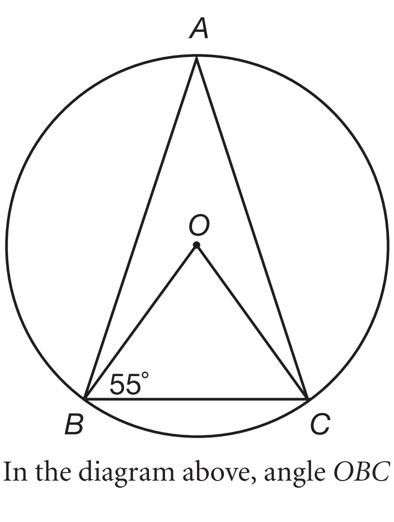
**15.** What is the perimeter of the shaded area, if the shape is a quarter circle with a radius of 8?



**a.** $2\pi$
**b.** $4\pi$
**c.** $2\pi + 16$
**d.** $4\pi + 16$
**e.** $16\pi$

**16.** Melanie compares two restaurant menus. The Scarlet Inn has two appetizers, five entrées, and four desserts. The Montgomery Garden offers three appetizers, four entrées, and three desserts. If a meal consists of an appetizer, an entrée, and a dessert, how many more meal combinations does the Scarlet Inn offer?

**17.**




In the diagram above, angle *OBC* is congruent to angle *OCB*. How many degrees does angle *A* measure?

**18.** Find the positive value that makes the function $f(a) = \frac{4a^2 + 12a + 9}{a^2 - 16}$ undefined.

**19.** Kiki is climbing a mountain. His elevation at the start of today is 900 feet. After 12 hours, Kiki is at an elevation of 1,452 feet. On average, how many feet did Kiki climb per hour today?

**20.** Freddie walks three dogs, which weigh an average of 75 pounds each. After Freddie begins to walk a fourth dog, the average weight of the dogs drops to 70 pounds. What is the weight in pounds of the fourth dog?

**21.** Kerry began lifting weights in January. After 6 months, he can lift 312 pounds, a 20% increase in the weight he could lift when he began. How much weight could Kerry lift in January?

**22.**

| RECYCLER | ALUMINUM | CARDBOARD | GLASS | PLASTIC |
|---|---|---|---|---|
| $x$ | .06/pound | .03/pound | .08/pound | .02/pound |
| $y$ | .07/pound | .04/pound | .07/pound | .03/pound |

If you take recyclables to whichever recycler will pay the most, what is the greatest amount of money you could get for 2,200 pounds of aluminum, 1,400 pounds of cardboard, 3,100 pounds of glass, and 900 pounds of plastic?

**23.** The sum of three consecutive integers is 60. Find the least of these integers.

**24.** What is the sixth term of the sequence: $\frac{1}{3}, \frac{1}{2}, \frac{3}{4}, \frac{9}{8}, \ldots$?

**25.** The graph of the equation $\frac{2x-3}{3y} = 4$ crosses the $y$-axis at the point $(0,a)$. Find the value of $a$.

**26.** The angles of a triangle are in the ratio 1:3:5. What is the measure, in degrees, of the largest angle of the triangle?

**27.** Each face of a cube is identical to two faces of rectangular prism whose edges are all integers larger than one unit in measure. If the surface area of one face of the prism is 9 square units and the surface area of another face of the prism is 21 square units, find the possible surface area of the cube.

**28.** The numbers 1 through 40 are written on 40 cards, one number on each card, and stacked in a deck. The cards numbered 2, 8, 12, 16, 24, 30, and 38 are removed from the deck. If Jodi now selects a card at random from the deck, what is the probability that the card's number is a multiple of 4 and a factor of 40?

**29.** Suppose the amount of radiation that could be received from a microwave oven varies inversely as the square of the distance from it. How many feet away must you stand to reduce your potential radiation exposure to $\frac{1}{16}$ the amount you could have received standing 1 foot away?

**30.** The variable $x$ represents Cindy's favorite number and the variable $y$ represents Wendy's favorite number. For this given $x$ and $y$, if $x > y > 1$, $x$ and $y$ are both prime numbers, and $x$ and $y$ are both whole numbers, how many whole number factors exist for the product of the girls' favorite numbers?

## ▶ Answers

**1. b.** Substitute $\frac{1}{8}$ for $w$. To raise $\frac{1}{8}$ to the exponent $\frac{2}{3}$, square $\frac{1}{8}$ and then take the cube root. $\frac{1}{8}^2 = \frac{1}{64}$, and the cube root of $\frac{1}{64} = \frac{1}{4}$.

**2. d.** Samantha is two years older than half of Michele's age. Since Michele is 12, Samantha is $(12 \div 2) + 2 = 8$. Ben is three times as old as Samantha, so Ben is 24.

**3. e.** Factor the expression $x^2 - 8x + 12$ and set each factor equal to 0:
$x^2 - 8x + 12 = (x - 2)(x - 6)$
$x - 2 = 0$, so $x = 2$
$x - 6 = 0$, so $x = 6$

**4. d.** Add up the individual distances to get the total amount that Mia ran; $0.60 + 0.75 + 1.4 = 2.75$ km. Convert this into a fraction by adding the whole number, 2, to the fraction $\frac{75}{100} \div \frac{25}{25} = \frac{3}{4}$. The answer is $2\frac{3}{4}$ km.

**5. c.** Since lines $EF$ and $CD$ are perpendicular, triangles $ILJ$ and $JMK$ are right triangles. Angles $GIL$ and $JKD$ are alternating angles, since lines $AB$ and $CD$ are parallel and cut by transversal $GH$. Therefore, angles $GIL$ and $JKD$ are congruent—they both measure 140 degrees. Angles $JKD$ and $JKM$ form a line. A line has 180 degrees, so the measure of angle $JKM = 180 - 140 = 40$ degrees. There are also 180 degrees in a triangle. Right angle $JMK$, 90 degrees, angle $JKM$, 40 degrees, and angle $x$ form a triangle. Angle $x$ is equal to $180 - (90 + 40) = 180 - 130 = 50$ degrees.

**6. c.** The area of a circle is equal to $\pi r^2$, where r is the radius of the circle. If the radius, $r$, is doubled ($2r$), the area of the circle increases by a factor of four, from $\pi r^2$ to $\pi(2r)^2 = 4\pi r^2$. Multiply the area of the old circle by four to find the new area of the circle:
$6.25\pi \text{ in}^2 \times 4 = 25\pi \text{ in}^2$.

**7. a.** The distance formula is equal to $\sqrt{((x_2 - x_1)^2 + (y_2 - y_1)^2)}$. Substituting the endpoints (–4,1) and (1,13), we find that $\sqrt{((-4 - 1)^2 + (1 - 13)^2)} = \sqrt{((-5)^2 + (-12)^2)} = \sqrt{25 + 144} = \sqrt{169} = 13$, the length of David's line.

**8. b.** A term with a negative exponent in the numerator of a fraction can be rewritten with a positive exponent in the denominator, and a term with a negative exponent in the denominator of a fraction can be rewritten with a positive exponent in the numerator. $(\frac{a^{-2}}{b^{-3}}) = (\frac{b^3}{a^2})$. When $(\frac{a^2}{b^3})$ is multiplied by $(\frac{b^3}{a^2})$, the numerators and denominators cancel each other out and you are left with the fraction $\frac{1}{1}$, or 1.

**9. e.** Since triangle $ABC$ is equilateral, every angle in the triangle measures 60 degrees. Angles $ACB$ and $DCE$ are vertical angles. Vertical angles are congruent, so angle $DCE$ also measures 60 degrees. Angle $D$ is a right angle, so $CDE$ is a right triangle. Given the measure of a side adjacent to angle $DCE$, use the cosine of 60 degrees to find the length of side $CE$. The cosine is equal to $\frac{\text{(adjacent side)}}{\text{(hypotenuse)}}$, and the cosine of 60 degrees is equal to $\frac{1}{2}$; $\frac{12}{x} = \frac{1}{2}$, so $x = 24$.

**10. d.** First, find 25% of $y$; $16 \times 0.25 = 4$. 10% of $x$ is equal to 4. Therefore, $0.1x = 4$. Divide both sides by 0.1 to find that $x = 40$.

**11. e.** The area of a triangle is equal to $(\frac{1}{2})bh$, where $b$ is the base of the triangle and $h$ is the height of the triangle. The area of triangle $BDC$ is 48 square units and its height is 8 units.
$48 = \frac{1}{2}b(8)$
$48 = 4b$
$b = 12$
The base of the triangle, $BC$, is 12. Side $BC$ is equal to side $AD$, the diameter of the circle.

The radius of the circle is equal to 6, half its diameter. The area of a circle is equal to $\pi r^2$, so the area of the circle is equal to $36\pi$ square units.

**12. d.** The sides of a square and the diagonal of a square form an isosceles right triangle. The length of the diagonal is $\sqrt{2}$ times the length of a side. The diagonal of the square is $16\sqrt{2}$ cm, therefore, one side of the square measures 16 cm. The area of a square is equal to the length of one side squared: $(16 \text{ cm})^2 = 256 \text{ cm}^2$.

**13. a.** If both sides of the inequality $\frac{m}{2} > \frac{n}{2}$ are multiplied by 2, the result is the original inequality, $m > n$. $m^2$ is not greater than $n^2$ when $m$ is a positive number such as 1 and $n$ is a negative number such as –2. $mn$ is not greater than zero when $m$ is positive and $n$ is negative. The absolute value of $m$ is not greater than the absolute value of $n$ when $m$ is 1 and $n$ is –2. The product $mn$ is not greater than the product $-mn$ when $m$ is positive and $n$ is negative.

**14. c.** There are 60 minutes in an hour and 120 minutes in two hours. If 4 liters are poured every 3 minutes, then 4 liters are poured 40 times $(120 \div 3)$; $40 \times 4 = 160$. The tank, which holds 2,000 liters of water, is filled with 160 liters; $\frac{160}{2{,}000} = \frac{8}{100}$. 8% of the tank is full.

**15. d.** The curved portion of the shape is $\frac{1}{4}\pi d$, which is $4\pi$. The linear portions are both the radius, so the solution is simply $4\pi + 16$.

**16. 4** Multiply the number of appetizers, entrées, and desserts offered at each restaurant. The Scarlet Inn offers $(2)(5)(4) = 40$ meal combinations, and the Montgomery Garden offers $(3)(4)(3) = 36$ meal combinations. The Scarlet Inn offers four more meal combinations.

**17. 35** Angles $OBC$ and $OCB$ are congruent, so both are equal to 55 degrees. The third angle in the triangle, angle $O$, is equal to $180 - (55 + 55) = 180 - 110 = 70$ degrees. Angle $O$ is a central angle; therefore, arc $BC$ is also equal to 70 degrees. Angle $A$ is an inscribed angle. The measure of an inscribed angle is equal to half the measure of its intercepted arc. The measure of angle $A = 70 \div 2 = 35$ degrees.

**18. 4** The function $f(a) = \frac{(4a^2 + 12a + 9)}{(a^2 - 16)}$ is undefined when its denominator is equal to zero; $a^2 - 16$ is equal to zero when $a = 4$ and when $a = -4$. The only positive value for which the function is undefined is 4.

**19. 46** Over 12 hours, Kiki climbs $(1{,}452 - 900) = 552$ feet. On average, Kiki climbs $(552 \div 12) = 46$ feet per hour.

**20. 55** The total weight of the first three dogs is equal to $75 \times 3 = 225$ pounds. The weight of the fourth dog, $d$, plus 225, divided by 4, is equal to the average weight of the four dogs, 70 pounds:

$\frac{d + 225}{4} = 70$

$d + 225 = 280$

$d = 55$ pounds

**21. 260** The weight Kerry can lift now, 312 pounds, is 20% more, or 1.2 times more, than the weight, $w$, he could lift in January:

$1.2w = 312$

$w = 260$ pounds

**22. 485** 2,200(0.07) equals \$154; 1,400(0.04) equals \$56; 3,100(0.08) equals \$248; 900(0.03) equals \$27. Therefore, \$154 + \$56 + \$248 + \$27 = \$485.

**23. 19** Let $x$, $x + 1$, and $x + 2$ represent the consecutive integers. The sum of these integers is 60: $x + x + 1 + x + 2 = 60$, $3x + 3 = 60$, $3x = 57$, $x = 19$. The integers are 19, 20, and 21, the smallest of which is 19.

**24.** $\frac{81}{32}$ Each term is equal to the previous term multiplied by $\frac{3}{2}$. The fifth term in the sequence is $\frac{9}{8} \times \frac{3}{2} = \frac{27}{16}$, and the sixth term is $\frac{27}{16} \times \frac{3}{2} = \frac{81}{32}$.

**25.** $-\frac{1}{4}$ The question is asking you to find the $y$-intercept of the equation $\frac{2x-3}{3y} = 4$. Multiply both sides by 3y and divide by 12: $y = \frac{1}{6}x - \frac{1}{4}$. The graph of the equation crosses the $y$-axis at $(0,-\frac{1}{4})$.

**26.** **100** Set the measures of the angles equal to $1x$, $3x$, and $5x$. The sum of the angle measures of a triangle is equal to 180 degrees:

$1x + 3x + 5x = 180$

$9x = 180$

$x = 20$

The angles of the triangle measure 20 degrees, 60 degrees, and 100 degrees.

**27.** **54** One face of the prism has a surface area of nine square units and another face has a surface area of 21 square units. These faces share a common edge. Three is the only factor common to 9 and 21 (other than one), which means that one face measures three units by three units and the other measures three units by seven units. The face of the prism that is identical to the face of the cube is in the shape of a square, since every face of a cube is in the shape of a square. The surface area of the square face is equal to nine square units, so surface area of one face of the cube is nine square units. A cube has six faces, so the surface area of the cube is $9 \times 6 = 54$ square units.

**28.** $\frac{1}{11}$ Seven cards are removed from the deck of 40, leaving 33 cards. There are three cards remaining that are both a multiple of 4 and a factor of 40: 4, 20, and 40. The probability of selecting one of those cards is $\frac{3}{33}$ or $\frac{1}{11}$.

**29.** **4** We are seeking $D$ = number of feet away from the microwave where the amount of radiation is $\frac{1}{16}$ the initial amount. We are given: radiation varies inversely as the square of the distance or: $R = 1 \div D^2$. When $D = 1$, $R = 1$, so we are looking for $D$ when $R = \frac{1}{16}$. Substituting: $\frac{1}{16} = 1 \div D^2$. Cross multiplying: $(1)(D^2) = (1)(16)$. Simplifying: $D^2 = 16$, or $D = 4$ feet.

**30.** **4** The factors of a number that is whole and prime are 1 and itself. For this we are given $x$ and $y$, $x > y > 1$ and $x$ and $y$ are both prime. Therefore, the factors of $x$ are 1 and $x$, and the factors of $y$ are 1 and $y$. The factors of the product $xy$ are 1, $x$, $y$, and $xy$. For a given $x$ and $y$ under these conditions, there are four factors for $xy$, the product of the girls' favorite numbers.