# Franklin Math Bowl
## Algebra I
## 2009

All answers are presented accurate to three decimal places unless otherwise noted. Good luck!

1. Assuming that $x^2 - 5x + 6 \neq 0$, simplify $\frac{x^2-6x+9}{x^2-5x+6}$.

      a. $\frac{-3}{x-2}$    b. $\frac{x-2}{x-3}$    c. $\frac{x-3}{x+2}$    d. $\frac{1}{-2x}$    e. $\frac{x-3}{x-2}$

2. Evaluate $-3x^2 - 2yx$ if $x = -2$ and $y = 3$.

      a. -39    b. -24    c. -15    d. 0    e. 24

3. Simplify $5x - 4(3 - 2(x - 13))$.

      a. $-3x + 92$    b. $13x - 116$    c. $13x - 92$    d. $13x + 92$    e. $13x + 116$

4. To solve the equation $x^2 + \frac{1}{3}x = -1$ by completing the square, what term would you need to add to each side?

      a. $\left(\frac{1}{2}\right)^2$    b. $\frac{1}{2}$    c. 1    d. $\frac{1}{6}$    e. $\left(\frac{1}{6}\right)^2$

5. Solve the equation $3x^2 - 7x - 2 = 0$.

      a. $\frac{7\pm\sqrt{73}}{6}$    b. $\frac{2\pm\sqrt{88}}{6}$    c. $\frac{-3\pm\sqrt{65}}{14}$    d. $\frac{7\pm\sqrt{73}}{4}$    e. No real solutions

6. Suppose that you want to fence a six foot by seven foot rectangular garden on the side of your house. Hence, the side of the house is attached to the fence in such a way that the long side of the fence is parallel to the house. How much fencing (in feet) will you need?

a. 13    b. 19    c. 20    d. 26    e. 42

7. Solve for $x$: $|2x + 7| \geq 5$.

a. $x = -1$    b. $x = -1, -6$    c. $-6 \leq x \leq -1$    d. $x \geq -1$ or $x \leq -6$

8. Sue drives 50 miles at 60 miles an hour and then drives 100 miles at 65 miles an hour. What is her average speed for the entire trip (in miles an hour)?

a. 60    b. 61.667    c. 62.5    d. 63.243    e. 63.333

9. Find the dimensions of a rectangle with perimeter 67.2 m if the length is 4.6 times the width.

a. 10.182 m by 46.836 m    b. 3.822 m by 17.582 m    c. 6 m by 27.6 m    d. 12 m by 55.2 m

10. The word "per" in mathematics is a synonym for which of the following operations

a. addition    b. subtraction    c. multiplication    d. division    e. all of these

11. Find the volume of the box with width 1.5 cm, length 1.85 cm, and height 2.35 cm.

a. 5.7 $cm^3$    b. 6.3 $cm^3$    c. 7.123 $cm^3$    d. 6.521 $cm^3$    e. 7.873 $cm^3$

12. If $A = \frac{h}{2}(b_1 + b_2)$, find $b_2$ in terms of the other variables.

      a. $\frac{2A}{h} - b_1$   b. $\frac{-2A}{h} + b_1$   c. $\frac{2A}{h} + b_1$   d. $2A - \frac{b_1}{2}$   e. $A - \frac{b_1}{2}$

13. A bird's tail is twice the length of its body. Its head is one third the length of the body. Find the length of the bird if its tail is 6 cm.

      a. 3 cm   b. 5 cm   c. 7 cm   d. 9 cm   e. 10 cm

14. Find the equation of the line passing through the points $(2,5)$ and $(-1,3)$.

      a. $y = \frac{11}{3}x + \frac{2}{3}$   b. $y = \frac{3}{2}x + 2$   c. $y = \frac{3}{2}x + 8$   d. $y = \frac{2}{3}x + \frac{11}{3}$   e. $y = \frac{2}{3}x + \frac{19}{3}$

15. Simplify
$$\frac{x\sqrt{x} + \sqrt{x}}{x\sqrt{x} - \sqrt{x}} - \frac{x^2 + 1}{x^2 - 1}.$$

      a. $\frac{2}{x-1}$   b. $\frac{2x}{x^2-1}$   c. $\frac{\sqrt{x}}{x^2-1}$   d. $\frac{2\sqrt{x}}{x^2-1}$   e. 0

16. To get to your friend's house, you walk 500 meters due west and then 1200 meters due north. On the way home, you cut across a field and take the shortest possible route home. How far did you travel on the way home (in meters)?

      a. 850   b. 1300   c. 1700   d. 3000   e. 16900

17. Find the mean and median of the set $\{5, 1, 8, 3, 3\}$.

      a. 4 and 3.   b. 3 and 4   c. 3 and 3   d. 4 and 4   e. 4 and 8

18. A retail store normally sells a book for $15. They mark the book down 5% for a sale. At the end of the sale, they mark the price of the book up 5%. At what price are they now selling the book? Hint: The store will *always round up* to the nearest whole cent.

a. $14.25   b. $14.96   c. $14.97   d. $15   e. $15.75

19. At a concessions stand, you buy a hot dog and two bags of chips for $11. Your friend buys two hot dogs and a bag of chips for $13. How much do hot dogs (h) and chips (c) cost in dollars?

a. $\begin{array}{l} h = 3, \\ c = 5 \end{array}$   b. $\begin{array}{l} h = 5, \\ c = 3 \end{array}$   c. $\begin{array}{l} h = 4, \\ c = 1.5 \end{array}$   d. $\begin{array}{l} h = 4, \\ c = 5 \end{array}$   e. $\begin{array}{l} h = 4, \\ c = 4 \end{array}$

20. Every child at a party has either ice cream or cake (possibly both). Fifteen children have cake. Nine children have ice cream. Six children have both cake and ice cream. How many children were at the party?

a. 18   b. 20   c. 22   d. 24   e. 30

21. The student lockers at a local middle school are numbered consecutively beginning with locker 1. The plastic digits used to number the lockers cost three cents a piece. For instance, it costs three cents to label locker 9 and six cents to label locker 10. If it costs $207.87 to label all of the lockers, how many lockers are there?

a. 208   b. 999   c. 1010   d. 2009   e. 6929

22. Suppose that it takes Alice three hours to rake the leaves in a yard. It takes Bob four hours to rake the leaves in the same yard. How long (in hours) will it take them to rake the leaves if they work together?

a. .583   b. 1.714   c. 3   d. 3.5   e. 7

23. A simplified version of American football allows only Field goals (three points) and Touchdowns (seven points). What is the largest number that *cannot* be a score in this game?

<div align="center">a. 5   b. 8   c. 11   d. 13   e. 14</div>

24. The *Sierpinski graph* is constructed recursively as follows: Begin with a triangle, we call this graph $S_0$. To obtain $S_1$, we connect the midpoints on each edge of the triangle (see below). $S_n$ can be obtained by replacing each of the small upward pointing triangles in $S_1$ with a copy of $S_{n-1}$.



$S_0$        $S_1$              $S_2$
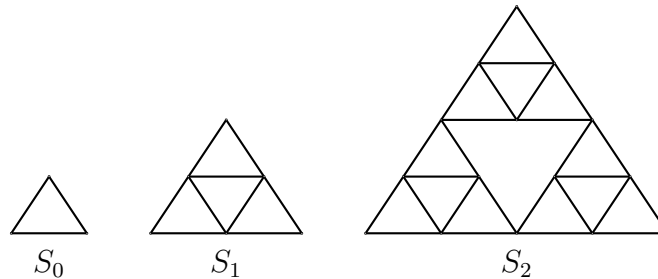
How many triangles are in $S_3$?

<div align="center">a. 17   b. 27   c. 40   d. 53   e. 161</div>

25. How many positive whole numbers less than or equal to 1500 are divisible by 2 or 3 (possibly both)?

<div align="center">a. 250   b. 500   c. 750   d. 1000   e. 1250</div>

# Solutions to Franklin Math Bow Algebra 2009

| | | | | |
|---|---|---|---|---|
| 1.e | 2.d | 3. b | 4. e | 5. a |
| 6.b | 7.d | 8.d | 9.c | 10.d |
| 11. d | 12.a | 13. e | 14. d | 15. b |
| 16. b | 17. a | 18. c | 19. b | 20. a |
| 21. d | 22. b. | 23. c | 24. d | 25. d |