# 1 Multiple Choice Solutions

1. **Problem:** The sum of 19.39 and 8.17 is
   - **Solution:** We perform vertical addition:

$$\begin{array}{r} 19.39 \\ +\ \ 8.17 \\ \hline 27.56 \end{array}$$

   - **Answer:** (d) 27.56

2. **Problem:** Express 517 hundredths as a decimal.
   - **Solution:** "517 hundredths" means 517 divided by 100.

$$\frac{517}{100} = 5.17$$

   - **Answer:** (c) 5.17

3. **Problem:** The product of 137.93 and 6 is
   - **Solution:** We perform multiplication:

$$\begin{array}{r} 137.93 \\ \times\ \ 6 \\ \hline 827.58 \end{array}$$

   - **Answer:** (c) 827.58

4. **Problem:** Which of the following figures below is not symmetrical?
   - **Solution:** A figure is symmetrical if a line of symmetry can be drawn through it, creating two mirror images.
     - (a) The location pin has a vertical line of symmetry.
     - (b) The briefcase has a vertical line of symmetry.
     - (c) The graduation cap is not symmetrical due to the item dangling from the top of the hat.
     - (d) The fast-forward icon has a horizontal line of symmetry.
     - (e) The umbrella has a vertical line of symmetry down the middle.
   - **Answer:** (c)

5. **Problem:** If $a$ is the third prime number after 4, what is the value of $a$?
   - **Solution:** We list the prime numbers after 4:
     (a) First prime after 4 is 5.
     (b) Second prime after 4 is 7.

(c) Third prime after 4 is 11.

Therefore, $a = 11$.

- **Answer:** (b) 11

6. **Problem:** Benny has a bag of marbles. Inside this bag, there are 2 blue marbles and 3 green marbles. What are the chances that if he chooses one at random, it is a blue marble?

   - **Solution:** The total number of marbles is 2 (blue) + 3 (green) = 5. The number of desired outcomes (blue marbles) is 2. The probability is $\frac{\text{Desired Outcomes}}{\text{Total Outcomes}}$.

   $$P(\text{blue}) = \frac{2}{5}$$

   - **Answer:** (c) $\frac{2}{5}$

7. **Problem:** $12.408 = 12 + 0.4 + \_$

   - **Solution:** We are breaking the number 12.408 into its place value components. $12.408 = 10 + 2 + 0.4 + 0.00 + 0.008$. The equation is $12.408 = 12 + 0.4 + x$. $12.408 = 12.4 + x$ $x = 12.408 - 12.4$ $x = 0.008$

   - **Answer:** (e) 0.008

8. **Problem:** The following sequence goes 1, 1, 2, 3, 5, $a$... What is the value of $a$?

   - **Solution:** This is the Fibonacci sequence, where each number is the sum of the two preceding ones. $1 + 1 = 2$
   $1 + 2 = 3$
   $2 + 3 = 5$
   $3 + 5 = 8$
   So, $a = 8$.

   - **Answer:** (b) 8

9. **Problem:** Benny bought 7.8 lbs of salt for his restaurant. He packed the salt equally into 12 bags. What was the weight of each bag?

   - **Solution:** We divide the total weight by the number of bags.

   $$\text{Weight per bag} = \frac{7.8 \text{ lbs}}{12 \text{ bags}} = 0.65 \text{ lbs}$$

   - **Answer:** (c) 0.65 lbs

10. **Problem:** The perimeter of a square is 64 ft. Find its area.

    - **Solution:** The perimeter of a square is $P = 4s$, where $s$ is the side length. $64 \text{ ft} = 4s$
    $s = \frac{64}{4} = 16 \text{ ft}$
    The area of a square is $A = s^2$.
    $A = (16 \text{ ft})^2 = 256 \text{ ft}^2$

- **Answer:** (a) 256 $\text{ft}^2$

11. **Problem:** The perimeter of a square is 144 in. Find its length.

    - **Solution:** "Length" refers to the side length $s$. The perimeter is $P = 4s$. 144 in $= 4s$
      $s = \frac{144}{4} = 36$ in
    - **Answer:** (b) 36 in.

12. **Problem:** What is the sum of the positive integer divisors of 14?

    - **Solution:** The positive integer divisors of 14 are the numbers that divide 14 evenly. Divisors: 1, 2, 7, 14.
      Sum $= 1 + 2 + 7 + 14 = 24$.
    - **Answer:** (d) 24

13. **Problem:** Benny sold 120 cookies for his school's fundraiser. He sold them at \$3.16 for 10 cookies. How much money did he get from selling the cookies?

    - **Solution:** First, find the number of "batches" of 10 cookies Benny sold. Batches $= \frac{120 \text{ cookies}}{10 \text{ cookies/batch}} = 12$ batches
      Next, multiply the number of batches by the price per batch.
      Total money $= 12$ batches $\times$ \$3.16/batch $=$ \$37.92
    - **Answer:** (d) \$37.92

14. **Problem:** If $(x^2)(4) = 64$ what is the value of $x$?

    - **Solution:** We solve the equation for $x$. $4x^2 = 64$
      $x^2 = \frac{64}{4}$
      $x^2 = 16$
      $x = \sqrt{16} = 4$
      (Assuming $x$ is positive, which is typical for such problems unless specified).
    - **Answer:** (c) 4

15. **Problem:** Benny is leaving his house, but can't decide what to wear. He has 5 coats, 3 hats, and 2 pairs of shoes. How many different outfits could he wear?

    - **Solution:** This is a counting problem. We multiply the number of options for each item. Total outfits = (Coats) $\times$ (Hats) $\times$ (Shoes)
      Total outfits $= 5 \times 3 \times 2 = 30$
    - **Answer:** (e) 30

16. **Problem:** If $2x + 3 = 4x - 1$, then what is the value of $11x$?

    - **Solution:** First, solve for $x$. $2x + 3 = 4x - 1$
      Subtract $2x$ from both sides:
      $3 = 2x - 1$

Add 1 to both sides:
$4 = 2x$
$x = 2$
Now, find the value of $11x$.
$11x = 11(2) = 22$

- **Answer:** (a) 22

17. **Problem:** Suppose 4 zips = 3 zaps. Also, suppose 2 zaps = 5 zops. How many zips are equivalent to 30 zops?

    - **Solution:** We work backward from 30 zops using unit conversion. We want 30 zops.
      From 2 zaps = 5 zops, we can say $1 = \frac{2 \text{ zaps}}{5 \text{ zops}}$.
      $30 \text{ zops} \times \left(\frac{2 \text{ zaps}}{5 \text{ zops}}\right) = \frac{60}{5} \text{ zaps} = 12 \text{ zaps}$
      Now, convert zaps to zips.
      From 4 zips = 3 zaps, we can say $1 = \frac{4 \text{ zips}}{3 \text{ zaps}}$.
      $12 \text{ zaps} \times \left(\frac{4 \text{ zips}}{3 \text{ zaps}}\right) = \frac{48}{3} \text{ zips} = 16 \text{ zips}$
    - **Answer:** (a) 16

18. **Problem:** Benny was born on January 1, 2000. His mother was born on January 1, 1975, and his father was born on January 1, 1970. In what year was the sum of their ages 100?

    - **Solution:** Let $Y$ be the year in question. On Jan 1 of year $Y$:
      - Benny's age $= Y - 2000$
      - Mother's age $= Y - 1975$
      - Father's age $= Y - 1970$

      We set the sum of their ages equal to 100:
      $(Y - 2000) + (Y - 1975) + (Y - 1970) = 100$
      $3Y - (2000 + 1975 + 1970) = 100$
      $3Y - 5945 = 100$
      $3Y = 6045$
      $Y = \frac{6045}{3} = 2015$
    - **Answer:** (e) 2015

19. **Problem:** Benny is now a farmer! He only has chickens and cows. If he owns 18 animals with a total of 66 legs, how many chickens does he have?

    - **Solution:** Let $c$ be the number of chickens (2 legs each) and $k$ be the number of cows (4 legs each). We have a system of two equations:
      (a) (Animals) $c + k = 18$
      (b) (Legs) $2c + 4k = 66$

From equation (1), $k = 18 - c$. Substitute this into equation (2):
$2c + 4(18 - c) = 66$
$2c + 72 - 4c = 66$
$-2c + 72 = 66$
$72 - 66 = 2c$
$6 = 2c$
$c = 3$
Benny has 3 chickens.

- **Answer:** (d) 3

20. **Problem:** Sarah has 10 fewer points than Benny. Benny has 4 more points than Chloe. Chloe has three times as many points as David. If David has 6 points, how many points does Sarah have?

    - **Solution:** We work backward from David's score.
        - David = 6 points.
        - Chloe = $3 \times$ David $= 3 \times 6 = 18$ points.
        - Benny = Chloe $+ 4 = 18 + 4 = 22$ points.
        - Sarah = Benny $- 10 = 22 - 10 = 12$ points.
    - **Answer:** (a) 12

# 2 Free Response Solutions

21. **Problem:** In square meters, what is the area of the diagram?

    - **Solution:** The labels in the diagram contain a contradiction (4 + 4 + 4 + 16 = 28, but the total height is 26). Assuming the middle arm's height is 2 m to make the vertical dimensions consistent (4+4+2+16=26), and then subtracting the empty areas from a large 15x26 rectangle gives the most probable answer.
      - Area of Large Rectangle = $15 \times 26 = 390$ m$^2$.
      - Area of upper cutout = $(15 - 6) \times 4 = 36$ m$^2$.
      - Area of lower cutout = $(15 - 6) \times 16 = 144$ m$^2$.
      - Total Area = $390 - 36 - 144 = 210$ m$^2$
    - **Answer:** 210 m$^2$

22. **Problem:** Benny puts together 8 congruent cubes, each with side length 7 meters, to form one big cube. What is the total perimeter of all of the faces of the big cube?

    - **Solution:**
      - 8 cubes ($2 \times 2 \times 2$) form the big cube.
      - The side length of a small cube is $s = 7$ m.
      - The side length of the big cube $S$ is 2 small cubes long: $S = 2 \times 7$ m $= 14$ m.
      - A cube has 6 faces. Each face is a square.
      - The perimeter of *one* face of the big cube is $P_{\text{face}} = 4 \times S = 4 \times 14$ m $= 56$ m.
      - The *total* perimeter of *all 6 faces* is $P_{\text{total}} = 6$ faces $\times$ 56 m/face.
      - $P_{\text{total}} = 336$ m.
    - **Answer:** 336 m

23. **Problem:** His first hose can fill the pool in 6 hours. His second hose can fill it in 9 hours. Working together, how long will it take, in minutes, for the two hoses to fill the pool?

    - **Solution:**
      - Rate of Hose 1 ($R_1$) = $\frac{1 \text{ pool}}{6 \text{ hours}}$
      - Rate of Hose 2 ($R_2$) = $\frac{1 \text{ pool}}{9 \text{ hours}}$
      - Combined Rate ($R_T$) = $R_1 + R_2 = \frac{1}{6} + \frac{1}{9}$
      - Find a common denominator (18): $R_T = \frac{3}{18} + \frac{2}{18} = \frac{5}{18}$ pools per hour.
      - The time $T$ to fill 1 pool is the reciprocal of the rate: $T = \frac{1}{R_T} = \frac{1}{5/18} = \frac{18}{5}$ hours.
      - $T = 3.6$ hours.
      - Convert to minutes: 3.6 hours $\times 60 \frac{\text{minutes}}{\text{hour}} = 216$ minutes.
    - **Answer:** 216 min

24. **Problem:** Benny is playing Monopoly. He needs to roll either a 7 or a 12 to avoid paying rent. As a fraction in simplest form, what is the probability that Benny doesn't have to pay rent? (Note: rolling 2 dice).

    - **Solution:**
        - Total possible outcomes with two 6-sided dice is $6 \times 6 = 36$.
        - Ways to roll a 7: (1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1). There are 6 ways.
        - Ways to roll a 12: (6, 6). There is 1 way.
        - Total successful outcomes = (Ways for 7) + (Ways for 12) $= 6 + 1 = 7$.
        - Probability $= \frac{\text{Successful Outcomes}}{\text{Total Outcomes}} = \frac{7}{36}$.
        - The fraction is already in simplest form.
    - **Answer:** $\frac{7}{36}$

25. **Problem:** In the following magic square, every row and column adds to the same value. Find X.

    - **Solution:**
        - A magic square has the same sum for every row and column.
        - We can find the "magic sum" $S$ from the first row:
        - $S = 13 + 11 + 17 = 41$.
        - Every row must add up to 41. The bottom row must also add up to 41:
        - $X + 17 + 13 = 41$
        - $X + 30 = 41$
        - $X = 11$
        - Similarly, the top row must also sum to 41:
        - $Y + 13 + 9 = 41$
        - $Y + 22 = 41$
        - $Y = 19$
        - Finally, we simply have to sum the middle column to 41:
        - $Z + 19 + 11 = 41$
        - $Z + 30 = 41$
        - $Z = 11$
    - **Answer:** 11