



DREAMLINE STEAM OLYMPIAD

7–8

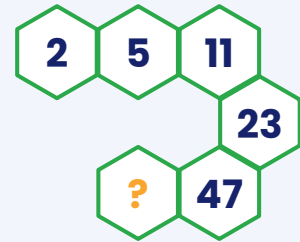
GRADE



Grade 7–8 Mathematics Olympiad Sample Questions

1

Find the missing number. 2,5,11,23,47,?

**A** 95**B** 96**C** 97**D** 99

Solution

$$2 \times 2 + 1 = 5$$

$$5 \times 2 + 1 = 11$$

$$11 \times 2 + 1 = 23$$

$$23 \times 2 + 1 = 47$$

$$47 \times 2 + 1 = 95$$

✓ Answer: A) 95

2

A rope is cut into three pieces.

- The first piece is $\frac{1}{3}$ of the rope.
- The second piece is $\frac{1}{4}$ of the rope.
- The third piece is 15 cm longer than the second piece.

How long is the rope?

**A** 60 cm**B** 75 cm**C** 80 cm**D** 90 cm

Solution: Third piece:

$$1 - \frac{1}{3} - \frac{1}{4} = \frac{5}{12}$$

Difference between third and second:

$$\frac{5}{12} - \frac{1}{4} = \frac{5}{12} - \frac{3}{12} = \frac{2}{12} = \frac{1}{6}$$

$$\frac{1}{6} \text{ of rope} = 15$$

Whole rope: $15 \times 6 = 90$

✓ Answer: 90 cm

3

Ali spent $\frac{1}{3}$ of his money on a book and $\frac{1}{4}$ of the remainder on a pen.

What fraction of his original money remains?

A $\frac{1}{3}$ B $\frac{1}{2}$ C $\frac{5}{12}$ D $\frac{5}{6}$

Solution: After book: $1 - \frac{1}{3} = \frac{2}{3}$

Spent on pen: $\frac{1}{4} \times \frac{2}{3} = \frac{1}{6}$

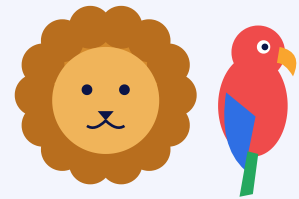
Remaining: $1 - \frac{1}{3} - \frac{1}{6} = \frac{1}{2}$

✓ Answer: $\frac{1}{2}$

4

A zoo keeper counted 25 animals in a special enclosure containing only lions and parrots. When he counted all the legs, he found 66 legs.

How many of the animals are lions?



A 8

B 10

C 12

D 14

Solution

Let L be the number of lions. Then parrots = $25 - L$.

Since lions have 4 legs and parrots have 2 legs:

$$4L + 2(25 - L) = 66$$

$$4L + 50 - 2L = 66$$

$$2L = 16$$

$$L = 8$$

✓ Answer: A) 8 lions.

5

A secret lock uses the digits 2, 4, and 6.

How many different 2-digit codes can be formed if no digit may be repeated?

**(A)** 4**(B)** 6**(C)** 8**(D)** 9

Solution: Choose the tens digit: 3 choices

Choose the units digit: 2 choices: $3 \times 2 = 6$

✓ Answer: B) 6

6

The average of five numbers is 24.

Four of the numbers are: 20, 22, 25, 28.

What is the fifth number?

(A) 23**(B)** 24**(C)** 25**(D)** 26

Solution: Total of all five numbers: $5 \times 24 = 120$

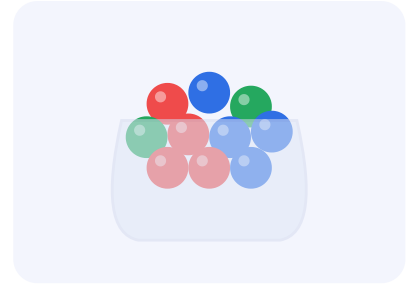
Sum of the four given numbers: $20 + 22 + 25 + 23 = 90$

Fifth number: $120 - 90 = 30$

✓ Answer: C) 25

7

A bag contains 4 red, 5 blue, and 3 green balls. What is the probability of selecting a blue ball at random?

(A) $1/3$ (B) $5/12$ (C) $1/2$ (D) $7/12$

Solution:

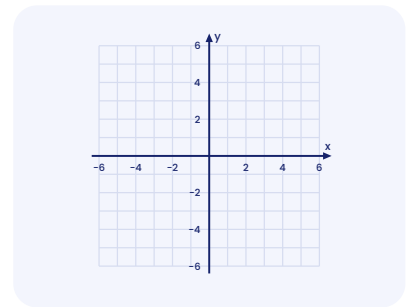
$$\text{Total balls} = 4 + 5 + 3 = 12$$

$$P(\text{blue}) = \frac{5}{12}$$

✓ Answer: B) $5/12$

8

Find the distance between $(2, 3)$ and $(8, 11)$.



(A) 8

(B) 10

(C) 12

(D) 14

Solution:

$$d = \sqrt{(8-2)^2 + (11-3)^2} = \sqrt{6^2 + 8^2} = \sqrt{100} = 10$$

✓ Answer: B) 10

9

A robot starts with 1000 energy cells. Every time it completes a mission, it uses 10% of its remaining energy. What will the robot's energy be after the 6th mission, according to this pattern?



(A) 478.296

(B) 522.321

(C) 529.322

(D) 531.441

Solution: **Start:** 1000

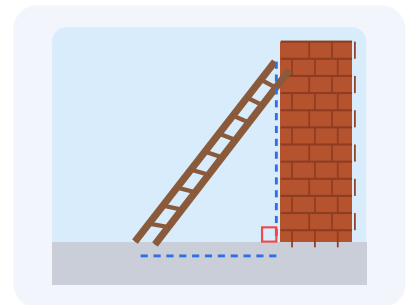
After Mission 1: 900 **After Mission 2:** 810

After Mission 3: 729 **After Mission 4:** 656.1

After Mission 5: 590.49 **After Mission 6:** 531.441

10

A ladder reaches 15 m up a wall. Its foot is 8 m from the wall. Find the ladder's length.



(A) 15

(B) 16

(C) 17

(D) 18

Solution:

$$c = \sqrt{15^2 + 8^2} = \sqrt{225 + 64} = \sqrt{289} = 17$$

✓ Answer: C) 17

11

A function satisfies $f(x) + f(y) = f(x + y)$ for all positive integers. If $f(1) = 3$, find $f(10)$.

(A) 20

(B) 27

(C) 30

(D) 33

Solution: Given $f(x) + f(y) = f(x + y)$ and $f(1) = 3$.

Put $y = 1$. Then $f(x + 1) = f(x) + f(1) = f(x) + 3$.

So every time we increase the input by 1, the value of f increases by 3:

$$f(1) = 3$$

$$f(2) = 3 + 3 = 6$$

$$f(3) = 6 + 3 = 9$$

and so on.

$$\text{Therefore, } f(10) = \underbrace{3 + 3 + \dots + 3}_{10 \text{ times}} = 3(10) = 30.$$

$$f(10) = 30$$

✓ Answer: C) 30

12

Find the value of $1001^2 - 999^2 + 999^2 - (999 - 1) \times (999 + 1)$.

(A) 2002

(B) 4001

(C) 6003

(D) 8004

Solution:

$$a^2 - b^2 = (a - b)(a + b) = (1001 - 999)(1001 + 999) = 2 \times 2000 = 4000$$

$$999^2 = (1000 - 1)^2 = 1000000 - 2000 + 1 = 998001$$

$$998 \times 1000 = 998000$$

$$998001 - 998000 = 1$$

✓ Answer: $4000 + 1 = 4001$

13

If $3(x - 2) - 2(x + 5) = 4x - 17$, and $\frac{y+3}{2} + \frac{y-1}{3} = 11$, find $x + y = ?$

(A) 1**(B)** $59/5$ **(C)** $127/10$ **(D)** $182/15$

Solution:

$$3x - 6 - 2x - 10 = 4x - 17$$

$$x - 16 = 4x - 17$$

$$3x = 1 \Rightarrow x = 1/3$$

$$3(y + 3) + 2(y - 1) = 66$$

$$3y + 9 + 2y - 2 = 66$$

$$5y + 7 = 66 \Rightarrow 5y = 59 \Rightarrow y = 59/5$$

$$x + y = \frac{182}{15}$$

✓ Answer: D) $182/15$

14

A robot is generating a secret number code: 5, 8, 14, 23, 35, ?

Each number follows a hidden pattern. Can you discover the rule and find the next number? What is the next number in the sequence:

**(A)** 48**(B)** 50**(C)** 52**(D)** 54

Solution:

Differences between consecutive terms: +3, +6, +9, +12.

The next difference is +15.

$$35 + 15 = 50$$

✓ Answer: B) 50

15

A businessman invests some money in a project.

- In the first year, the value of the investment **increases by 20%**.
- In the second year, due to market changes, the new value **decreases by 20%**.

After these two changes, by what percentage has the investment changed compared to the original amount?

**(A)** 0%**(B)** 2% decrease**(C)** 4% decrease**(D)** 4% increase

Solution:

$$1.20 \times 0.80 = 0.96 = 96\%$$

$$\text{Overall change} = 100\% - 96\% = 4\% \text{ decrease}$$

✓ Answer: C) 4% decrease

16

A homeowner wants to order a new carpet for a **triangular room**. Before placing the order, he needs to know the **floor area**.

The room has side lengths: 9 m, 12 m, 15 m

What is the area of the room?

**(A)** 48 m²**(B)** 54 m²**(C)** 60 m²**(D)** 72 m²

Solution:

Since $9^2 + 12^2 = 81 + 144 = 225 = 15^2$, it is a right-angled triangle.

$$\text{Area} = \frac{1}{2} (9) (12) = 54$$

✓ Answer: B) 54

17

How many 3-digit numbers can be formed from digits 1, 2, 3, 4, 5 without repetition?

(A) 20

(B) 40

(C) 60

(D) 120

Solution:

$$\text{Hundreds} \times \text{Tens} \times \text{Units} = 5 \times 4 \times 3 = 60$$

✓ Answer: C) 60

18

A rocket training center records the number of tests launches each week:

2, 6, 12, 20, 30, ...

The engineers notice a pattern and want to predict the number of launches in the **20th week**. What will the 20th term be?



(A) 380

(B) 400

(C) 410

(D) 420

Solution: Pattern: $a_n = n(n+1)$

$$a_{20} = 20 \times 21 = 420$$

✓ Answer: D) 420

19

The ratio of boys to girls is 5:7. If 12 more boys join, the ratio becomes 17:21. How many students were there originally?



(A) 180

(B) 200

(C) 216

(D) 240

Solution: Let boys = $5x$ and girls = $7x$.

$$\frac{5x + 12}{7x} = \frac{17}{21} \Rightarrow 105x + 252 = 119x \Rightarrow 14x = 252 \Rightarrow x = 18$$

$$\text{Original total} = 5x + 7x = 12x = 12(18) = 216$$

✓ Answer: C) 216

20

A treasure chest can only be opened by entering the **Greatest Common Divisor (GCD)** of two magical numbers:

252 and 378

What code opens the chest?


☐ (A) 42

☐ (B) 63

☒ (C) 126

☐ (D) 252

Solution:

$$252 = 2^2 \cdot 3^2 \cdot 7$$

$$378 = 2 \cdot 3^3 \cdot 7$$

$$\gcd(252, 378) = 2 \cdot 3^2 \cdot 7 = 126$$

✓ Answer: C) 126

21

What is the remainder when 7^{100} is divided by 6?

☒ (A) 1

☐ (B) 2

☐ (C) 4

☐ (D) 5

Solution:

$$7 \equiv 1 \pmod{6} \Rightarrow 7^{100} \equiv 1^{100} \equiv 1 \pmod{6}$$

✓ Answer: A) 1

22

Find all positive integer solutions of $x + y = 20$ and $xy = 96$.

☒ (A) (8, 12) and (12, 8)

☐ (B) (6, 14) and (14, 6)

☐ (C) (10, 10)

☐ (D) (4, 16) and (16, 4)

Solution: Substitute $y = 20 - x$:

$$x(20 - x) = 96 \Rightarrow x^2 - 20x + 96 = 0 \Rightarrow (x - 8)(x - 12) = 0$$

Solutions: $(x, y) = (8, 12)$ and $(12, 8)$

✓ Answer: A) (8, 12) and (12, 8)

23

How many positive divisors does 360 have?

(A) 12**(B)** 18**(C)** 22**(D)** 24

Solution: $360 = 2^3 \cdot 3^2 \cdot 5^1$

Number of divisors = $(3 + 1)(2 + 1)(1 + 1) = 4 \times 3 \times 2 = 24$

✓ Answer: D) 24

24

A giant factory has **100 machines**, numbered from **1 to 100**.

Machine n produces n parts, so the total number of parts produced is:

100!

The factory manager wants to know:

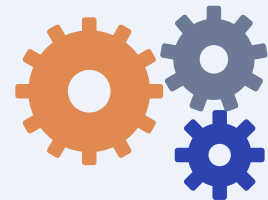
How many zeros are at the end of 100!?

(A) 20**(B)** 22**(C)** 24**(D)** 25

Solution:

$$\lfloor 100/5 \rfloor + \lfloor 100/25 \rfloor = 20 + 4 = 24$$

✓ Answer: C) 24



25

At a birthday party, **32 chocolate cookies** are shared equally among **4 children**. Before receiving their cookies, each child donates **2 cookies** to a charity box. If each cookie is worth **\$2**, what is the **total value of the cookies the children have left after the donation**?

**(A)** \$40**(B)** \$44**(C)** \$48**(D)** \$52**Solution**Each child receives: $32 \div 4 = 8$ Each child donates 2 cookies: $8 - 2 = 6$ Total cookies remaining: $4 \times 6 = 24$

Since each cookie is worth \$2:

$24 \times 2 = 48$

\$48

✓ Answer: C) \$48**26**

Find the missing number.

**(A)** 20**(B)** 21**(C)** 22**(D)** 23**Solution**

Differences: +1, +2, +3, +4, +5 Next: +6

$16 + 6 = 22$

✓ Answer: C) 22

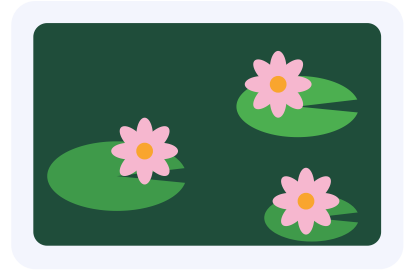
27

A frog is searching for a **golden lily pad**. Each jump is exactly **42 cm** long.

It makes:

- **7 jumps north**
- **5 jumps west**
- **3 jumps south**

What is the **total distance traveled in meters** during its journey?



(A) 5.46 m

(B) 5.88 m

(C) 6.12 m

(D) 6.3 m

Solution

Total number of jumps: $7 + 5 + 3 = 15$

Total distance: $15 \times 42 = 630$ cm

Convert to meters: $630 \div 100 = 6.3$ m

6.30 m

✓ **Answer: C) 6.30 m**

28

Find the simplest form.

$$\left[\left(\frac{3}{4} + \frac{5}{6} \right) \div \frac{19}{12} \right] \times \frac{\left(\frac{7}{8} + \frac{3}{4} \right)}{\left(2\frac{1}{2} + \frac{3}{4} \right) \times \frac{4}{5}}$$

Ⓐ $\frac{3}{4}$

Ⓑ $\frac{5}{6}$

Ⓒ $\frac{7}{8}$

Ⓓ $\frac{2}{6}$

Solution: Evaluate the numerator of the first fraction

$$\frac{3}{4} + \frac{5}{6} = \frac{9}{12} + \frac{10}{12} = \frac{19}{12}$$

$$\left(\frac{19}{12} \right) \div \left(\frac{19}{12} \right) = 1$$

Step 2:

$$2\frac{1}{2} + \frac{3}{4} = \frac{5}{2} + \frac{3}{4} = \frac{10}{4} + \frac{3}{4} = \frac{13}{4}$$

$$\frac{13}{4} \times \frac{4}{5} = \frac{13}{5}$$

Thus the first large fraction is $\frac{1}{13/5} = \frac{5}{13}$ **Step 3: Evaluate the second fraction**

Numerator: $\frac{7}{8} + \frac{3}{4} = \frac{7}{8} + \frac{6}{8} = \frac{13}{8}$

Denominator: $\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$

Therefore $\frac{13/8}{3/4} = \frac{13}{8} \times \frac{4}{3} = \frac{13}{6}$

Step 4: Multiply $\frac{5}{13} \times \frac{13}{6} = \frac{5}{6} \Rightarrow \boxed{\frac{5}{6}}$

29

A cinema sells:

- Adult tickets for **\$12**
- Student tickets for **\$7**

A total of **34 tickets** were sold, generating **\$323**.

How many adult tickets were sold?

**A** 17**B** 18**C** 19**D** 22**Solution:** Let a be the number of adult tickets.

$$a + s = 34$$

$$12a + 7s = 323$$

Substitute $s = 34 - a$:

$$12a + 7(34 - a) = 323$$

$$12a + 238 - 7a = 323$$

$$5a = 85$$

$$a = 17$$

17

✓ **Answer: A) 17****30**

Find the next number: 2, 3, 7, 16, 32, 57, ...

A 89**B** 91**C** 93**D** 97**Solution:**

Examine the differences between consecutive terms:

- $3 - 2 = 1 = 1^2$
- $7 - 3 = 4 = 2^2$
- $16 - 7 = 9 = 3^2$
- $32 - 16 = 16 = 4^2$
- $57 - 32 = 25 = 5^2$

The sequence of differences consists of perfect squares ($1^2, 2^2, 3^2, 4^2, 5^2, \dots$).Next difference: $6^2 = 36$ Next term: $57 + 36 = 93$ ✓ **Answer: C) 93**