**1.** Convert the decimal number 30_{10} to binary.

2. Find the remainder when $(14 + 18) \cdot (23 - 2)$ is divided by 11. Write your answer as a nonnegative integer from 0 to 10.

3. The market price of a washing machine in March was \$2000. In April its price rose by 30%. Then, in May a shopkeeper allowed a discount of 30% on the machine. Find its selling price in May after the discount.

4. Graph of which function $(a, b, c$ or $d)$ is given in the xy-plane below?
  a. $y = 2x - 2;$ **b.** $y = \dfrac{x}{2} + 2;$ **c.** $y = -\dfrac{x}{2} + 2;$ **d.** $y = -2x + 2.$
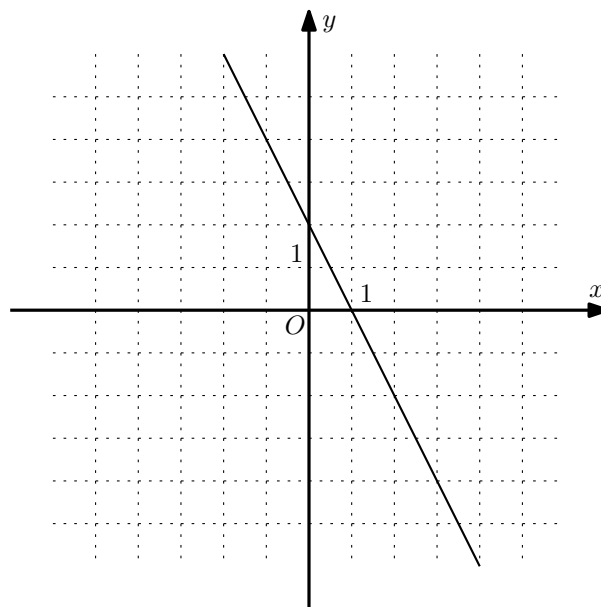
5. Given the parabola $y = -x^2 + 4x - 4,$
   a) find the minimal x-coordinate of its intersection with the x-axis;

   b) find the y-coordinate of its maximum.

6. Find the value of x if $2 \cdot 2^{x+1} + 4 \cdot 2^x = 2^{2x+1}.$

7. Find the largest root of the quadratic equation $x^2 - x - 20 = 0.$

8. Solve the inequality $\log_2(x\sqrt{x} + 5\sqrt{x}) + \log_{1/2} \sqrt{x} \geqslant 2.$ Choose the right answer:
   a) $[-1, +\infty),$ **b)** $(0, +\infty),$ **c)** $[1, +\infty),$ **d)** $(-\infty, -1],$ **e)** $(-\infty, 0),$ **f)** $(0, 1].$

9. The complete graph of the function $y = f(x)$ is shown in the xy-plane below. Find x such that the value $f(x)$ is the smallest possible.
What is the number of all preimages of $y = 1$?
Express your answers as integers separated by a comma.
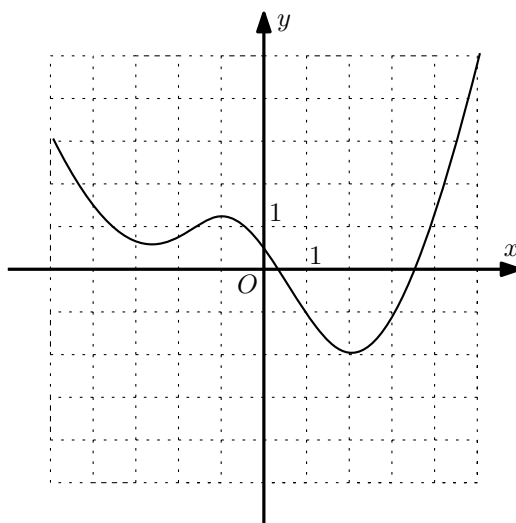
10. A geometric progression has 625 as the first term. The product of its first 3 terms is equal to the product of its first 6 terms. Find the common ratio of the progression. Give your answer as a decimal fraction rounded to one decimal place.

11. Given $f(x) = x^3 - 5x + 8$, find $f'(-1)$.

12. Calculate the binary number that equals $101001_2 - 11110_2 + 10110_2$. Write your answer as a binary number.

13. There is a swimming pool and three hoses: red, green, and blue. It takes 3 hours to fill the pool with the red hose. It also takes 45 minutes to fill it with the red and blue hoses at same time and 90 minutes to fill it with red and green hoses at same time. How long does it take to fill the pool with all three hoses at same time? Write your answer in minutes.

14. A robot is placed in the maze below in A1 position. It is programmed to do the following:

- if the robot is able to move down, then it moves down;

- if the robot is not able to move down, then it makes one step up and one step right;

- if the robot is not able to move right or up, then it stops and the program terminates.

Where will the robot stop after executing the program? Give your answer as a pair of a letter and a number, e.g. B4.

1 2 3 4 5 6

A B C D E F
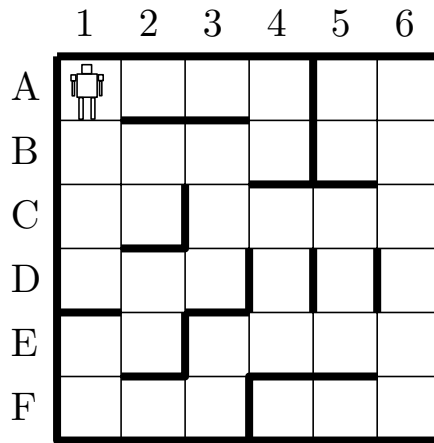
15. There are two operations:
   A: multiply a given number by 2 and add 1;
   B: add 3 to a given number.
   How to get 60 from 1 in **7** steps using operations **A** and **B**? Write your answer as a sequence of symbols **A** and **B**. (Example: **ABB** turns 1 to 9).

16. James has \$1000 and wants to invest it in a project. He knows that each dollar brings \$2 income per month. He may rent a number of billboards for \$100 each. Each billboard increases one dollar's income by \$1 per month. Find the James' maximal total month income. Write your answer in dollars.

17. A polynomial $p(x) = (x^4 - 3x^3 - x + 1)^9$ is written in standard form. Find the sum of all its coefficients.

18. Let us say that an integer n

   • is of type **A** if it is divisible by 4 **or** is divisible by 6;

   • is of type **B** if it is even **and** is divisible by 9.

   Which of the following statements are true?
   1. If a number is of type **A**, then it is also of type **B**;
   2. If a number is of type **B**, then it is also of type **A**;
   3. 70 is not of type **A** and is not of type **B**.
   4. If a is of type **A** and b is of type **B**, then $45a + 20b$ is always divisible by 90.
   Write down the numbers of the true statements in ascending order. (Example: 134).

19. How many ways are there to tile a 2×7 rectangle with 7 dominoes (identical 1×2 rectangles)?

20. Find the minimal positive integer n such that the decimal representation of $n \cdot 18$ consists of all twos.