Лаб: Основни математически концепции - Решения

1. Преобразуване от двоична в десетична бройна система

a) $1010101_{(2)} = 85_{(10)}$

$$a) \quad 1010101_{(2)} =$$
$$= 1 \cdot 2^6 + 0 \cdot 2^5 + 1 \cdot 2^4 + 0 \cdot 2^3 + 1 \cdot 2^2 + 0 \cdot 2^1 + 1 \cdot 2^0 =$$
$$= 64 + 0 + 16 + 0 + 4 + 0 + 1 = 85_{(10)}$$

b) $111111000_{(2)} = 504_{(10)}$

$$b) \quad 111111000_{(2)} =$$
$$= 1 \cdot 2^8 + 1 \cdot 2^7 + 1 \cdot 2^6 + 1 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 0 \cdot 2^2 + 0 \cdot 2^1 + 0 \cdot 2^0 =$$
$$= 256 + 128 + 64 + 32 + 16 + 8 + 0 + 0 + 0 =$$
$$= 504_{(10)}$$

c) $1010110011_{(2)} = 691_{(10)}$

$$c) \quad 1010110011_{(2)} =$$
$$= 1 \cdot 2^9 + 0 \cdot 2^8 + 1 \cdot 2^7 + 0 \cdot 2^6 + 1 \cdot 2^5 + 1 \cdot 2^4 + 0 \cdot 2^3 + 0 \cdot 2^2 + 1 \cdot 2^1 + 1 \cdot 2^0 =$$
$$= 512 + 0 + 128 + 0 + 32 + 16 + 0 + 0 + 2 + 1 =$$
$$= 691_{(10)}$$

d) $1011100010_{(2)} = 738_{(10)}$

$$d) \quad 1011100010_{(2)} =$$
$$= 1 \cdot 2^9 + 0 \cdot 2^8 + 1 \cdot 2^7 + 1 \cdot 2^6 + 1 \cdot 2^5 + 0 \cdot 2^4 + 0 \cdot 2^3 + 0 \cdot 2^2 + 1 \cdot 2^1 + 0 \cdot 2^0 =$$
$$= 512 + 0 + 128 + 64 + 32 + 0 + 0 + 0 + 2 + 0 =$$
$$= 738_{(10)}$$

2. Преобразуване от шестнадесетична в десетична бройна система

a) $B24A_{(16)} = 45642_{(10)}$

$$a) \quad B24A_{(16)} =$$
$$= B \cdot 16^3 + 2 \cdot 16^2 + 4 \cdot 16^1 + A \cdot 16^0 =$$
$$= 11 \cdot 4096 + 2 \cdot 256 + 4 \cdot 16 + 10 =$$
$$= 45056 + 512 + 64 + 10 =$$
$$= 45642_{(10)}$$

b) $DF3_{(16)} = 3571_{(10)}$

$$b) \quad DF3_{(16)} =$$
$$= D \cdot 16^2 + F \cdot 16^1 + 3 \cdot 16^0 =$$
$$= 13 \cdot 256 + 15 \cdot 16 + 3 \cdot 1 =$$
$$= 3328 + 240 + 3 =$$
$$= 3571_{(10)}$$

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c) EFB9$_{(16)}$ = 61369$_{(10)}$

$$EFB9_{(16)} =$$
$$= E \cdot 16^3 + F \cdot 16^2 + B \cdot 16^1 + 9 \cdot 16^0 =$$
$$= 14 \cdot 4096 + 15 \cdot 256 + 11 \cdot 16 + 9 \cdot 1 =$$
$$= 57344 + 3840 + 176 + 9 =$$
$$= 61369_{(10)}$$

d) CDE3$_{(16)}$ = 52707$_{(10)}$

$$CDE3_{(16)} =$$
$$= C \cdot 16^3 + D \cdot 16^2 + E \cdot 16^1 + 3 \cdot 16^0 =$$
$$= 12 \cdot 4096 + 13 \cdot 256 + 14 \cdot 16 + 3 \cdot 1 =$$
$$= 49152 + 3328 + 224 + 3 =$$
$$= 52707_{(10)}$$

3. Преобразуване от десетична в двоична бройна система

a) 59$_{(10)}$ = 111011$_{(2)}$

59	2	ост. 1
29	2	0 ст. 1
14	2	0 ст. 0
7	2	0 ст. 1
3	2	0 ст. 1
1	2	0 ст. 1
0		

b) $325_{(10)} = 101000101_{(2)}$

b) $325_{(10)} = 101\ 000\ 101_{(2)}$

325	2	OCT.	1
162	2	OCT.	0
81	2	OCT.	1
40	2	OCT.	0
20	2	OCT.	0
10	2	OCT.	0
5	2	OCT.	1
2	2	OCT.	0
1	2	OCT.	1
0			

c) $456_{(10)} = 111001000_{(2)}$

c) $456_{(10)} = 1110\ 01000_{(2)}$

456	2	OCT.	0
228	2	OCT.	0
114	2	OCT.	0
57	2	OCT.	1
28	2	OCT.	0
14	2	OCT.	0
7	2	OCT.	1
3	2	OCT.	1
1	2	OCT.	1
0			

d) $35_{(10)} = 100011_{(2)}$

d) $35_{(10)} = 100011_{(2)}$

35	2	OCT.	1
17	2	OCT.	1
8	2	OCT.	0
4	2	OCT.	0
2	2	OCT.	0
1	2	OCT.	1
0			

4. Преобразуване от шестнадесетична в двоична бройна система

a) $AC53_{(16)} = 1010110001010011_{(2)}$

a) $AC53_{(16)} =$

$= 1010 \quad 1100 \quad 0101 \quad 0011_{(2)}$

b) $BA23_{(16)} = 1011101000100011_{(2)}$

b) $BA23_{(16)} =$

$= 1011 \quad 1010 \quad 0010 \quad 0011_{(2)}$

c) $7CA2_{(16)} = 0111110010100010_{(2)}$

c) $7CA2_{(16)} =$

$= 0111 \quad 1100 \quad 1010 \quad 0010_{(2)}$

d) $14A8_{(16)} = 0001010010101000_{(2)}$

d) $14A8_{(16)} =$

$= 0001 \quad 0100 \quad 1010 \quad 1000_{(2)}$

5. Преобразуване от десетична в шестнадесетична бройна система

a) $54_{(10)} = 36_{(16)}$

a) $54_{(10)} = 36_{(16)}$

54	16	ост. 6
3	16	ост. 3
0		

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b) $475_{(10)} = 1DB_{(16)}$

$$475_{(10)} = 1DB_{(16)}$$

475	16	ост. 11 = B
29	16	ост. 13 = D
1	16	ост. 1
0		

c) $6234_{(10)} = 185A_{(16)}$

$$6234_{(10)} = 185A_{(16)}$$

6234	16	ост. 10 = A
389	16	ост. 5
24	16	ост. 8
1	16	ост. 1
0		

d) $352_{(10)} = 160_{(16)}$

$$352_{(10)} = 160_{(16)}$$

352	16	ост. 0
22	16	ост. 6
1	16	ост. 1
0		

6. Преобразуване от двоична в шестнадесетична бройна система

a) $1110101_{(2)} = 75_{(16)}$

$$01110101_{(2)} = 75_{(16)}$$

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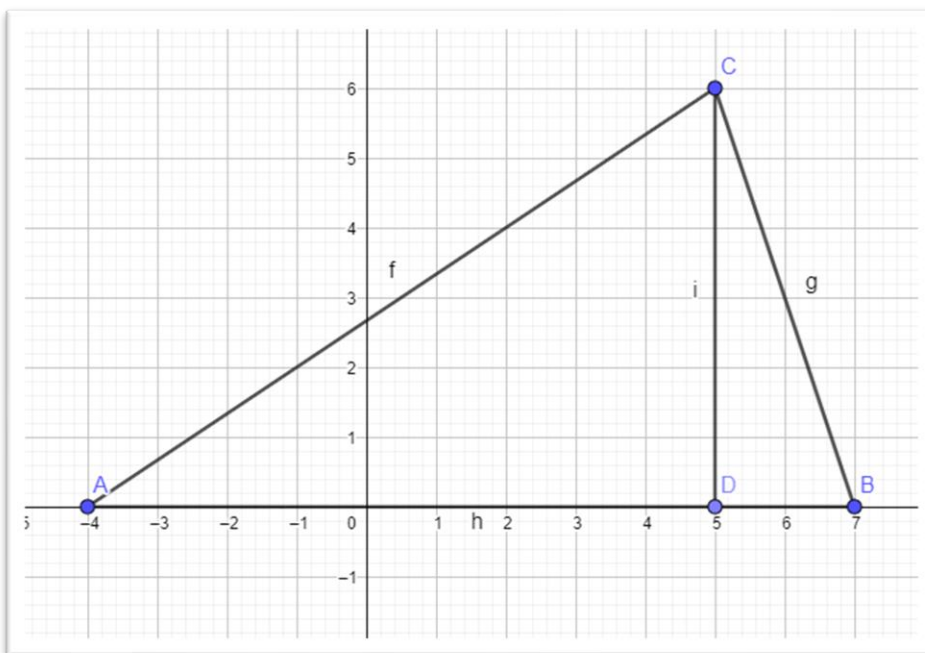b) $10110_{(2)} =$

c) $10101101_{(2)} = AD_{(16)}$

d) $10111010_{(2)} = BA_{(16)}$

7. Координатна система

a) Чертеж:
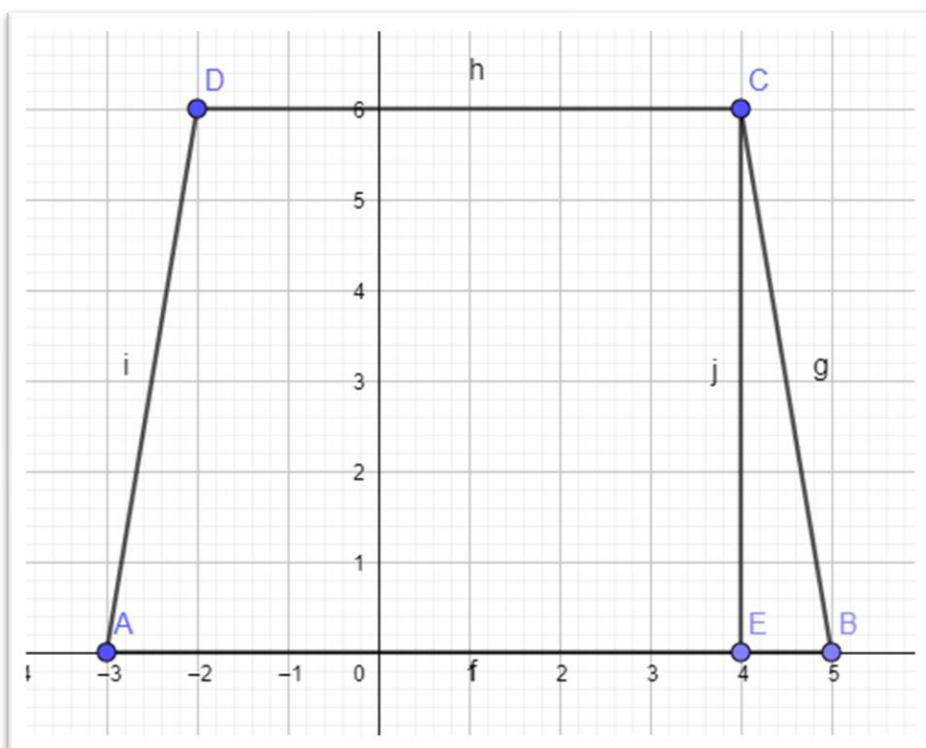
Решение:

а) $AB = 11$ см

Построване отсечка $CD \perp AB$,

където $D \in AB \Rightarrow CD = 6$ см

$S_{\triangle ABC} = \dfrac{AB \cdot CD}{2} = \dfrac{6 \cdot 11}{2} = \dfrac{66}{2} = 33$ см²

b) Чертеж:

Решение:

b) $AB = 8$ см

$CD = 6$ см

Построване отсечка $CE \perp AB$,

където $E \in AB \Rightarrow CE = 6$ см

$S_{ABCD} = \dfrac{(AB + CD)}{2} \cdot CE = \dfrac{(8+6)}{2} \cdot 6 = 14 \cdot 3 = 42$ см²

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8. Квадратно уравнение

a) $x^2 + 21x + 111 = 0$

$$a) \quad x^2 + 21x + 111 = 0$$
$$D = 21^2 - 4 \cdot 1 \cdot 111 =$$
$$= 441 - 444 = -3$$
$$D < 0 \Rightarrow \text{уравнението}$$
$$\text{няма реални корени}$$

b) $x^2 + 3x - 70 = 0$

$$b) \quad x^2 + 3x - 70 = 0$$
$$D = 9 - 4 \cdot 1 \cdot (-70) =$$
$$= 9 + 280 = 289$$
$$D > 0 \Rightarrow \text{уравнението}$$
$$\text{има два реални корена}$$
$$x_1 = \frac{-b + \sqrt{D}}{2a} = \frac{-3 + \sqrt{289}}{2 \cdot 1} =$$
$$= \frac{-3 + 17}{2} = \frac{14}{2} = 7$$
$$x_2 = \frac{-b - \sqrt{D}}{2a} = \frac{-3 - \sqrt{289}}{2 \cdot 1} =$$
$$= \frac{-3 - 17}{2} = \frac{-20}{2} = -10$$
$$\text{Отговор: } x_1 = 7 \text{; } x_2 = -10$$

c) $x^2 - 12x + 35 = 0$

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c) $x^2 - 12x + 35 = 0$

$D = (-12)^2 - 4 \cdot 1 \cdot 35 =$

$= 144 - 140 = 4$

$D > 0 \Rightarrow$ уравнението

има два корена

$x_1 = -\dfrac{b + \sqrt{D}}{2a} = \dfrac{-(-12) + \sqrt{4}}{2 \cdot 1} =$

$= \dfrac{12 + 2}{2} = \dfrac{14}{2} = 7$

$x_2 = \dfrac{-b - \sqrt{D}}{2a} = \dfrac{-(-12) - \sqrt{4}}{2 \cdot 1} =$

$= \dfrac{12 - 2}{2} = 5$

Отговор: $x_1 = 7$, $x_2 = 5$

d) $x^4 - 6x^2 + 5 = 0$

d) $x^4 - 6x^2 + 5 = 0$

$(x^2)^2 - 6x^2 + 5 = 0$

Полагаме: $x^2 = y$, където $y > 0$

$y^2 - 6y + 5 = 0$

$D = (-6)^2 - 4 \cdot 1 \cdot 5 = 36 - 20 = 16$

$y_1 = \dfrac{-b + \sqrt{D}}{2a} = \dfrac{-(-6) + \sqrt{16}}{2 \cdot 1} = \dfrac{6 + 4}{2} = 5$

$y_2 = \dfrac{-b - \sqrt{D}}{2a} = \dfrac{-(-6) - \sqrt{16}}{2 \cdot 1} = \dfrac{6 - 4}{2} = 1$

Обратно полагане:

$x^2 = y_1 \Rightarrow x^2 = 5 \Rightarrow x = \pm\sqrt{5}$

$x^2 = y_2 \Rightarrow x^2 = 1 \Rightarrow x = \pm 1$

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