Matemática B – Semi-Extensivo – V. 3

Exercícios

01) A(x, x); B(–2, –1); C(7, 2)

$d_{A,B} = d_{A,C}$

$\sqrt{(x+2)^2 + (x+1)^2} = \sqrt{(x-7)^2 + (x-2)^2}$

$\cancel{x^2} + 4x + \cancel{4} + \cancel{x^2} + 2x + 1$

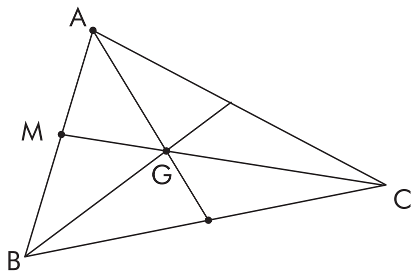
$= \cancel{x^2} - 14x + 49 + \cancel{x^2} - 4x + \cancel{4}$

$24x = 48$

$x = 2$

A(2, 2)

02) A(1, 1); G(3, 3); M(3, 1)



$B(x_B, y_B)$

$x_M = \dfrac{x_A + x_B}{2}$

$3 = \dfrac{1 + x_B}{2}$

$x_B = 5$

$y_M = \dfrac{y_A + y_B}{2}$

$1 = \dfrac{1 + y_B}{2}$

$y_B = 1$

B(5, 1)

$C(x_C, y_C)$

$x_G = \dfrac{x_A + x_B + x_C}{3}$

$3 = \dfrac{1 + 5 + x_C}{3}$

$x_C = 3$

$y_G = \dfrac{y_A + y_B + y_C}{3}$

$3 = \dfrac{1 + 1 + y_C}{3}$

$y_C = 7$

C(3, 7)

03) A(–2, –1); B(3, 3); $C(x_C, y_C)$

$\dfrac{\overline{BC}}{\overline{AB}} = 3$

$\dfrac{x_C - x_B}{x_B - x_A} = 3$

$\dfrac{x_C - 3}{3 + 2} = 3$

$x_C = 18$

$\dfrac{y_C - y_B}{y_B - y_A} = 3$

$\dfrac{y_C - 3}{3 + 1} = 3$

$y_C = 15$

C(18, 15)

04) C

A(–2, y); B(6, 7)

$d_{AB} = 10$

$\sqrt{(-2-6)^2 + (y-7)^2} = 10$

$64 + y^2 - 14y + 49 = 100$

$y^2 - 14y + 13 = 0 \quad \begin{cases} y' = 1 \\ y'' = 13 \end{cases}$

05) A(–1, –1); B(5, –7); C(x, 2)

$d_{C,A} = d_{C,B}$

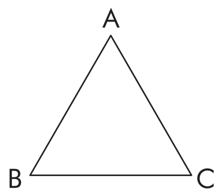
$\left(\sqrt{(x+1)^2 + (2+1)^2}\right)^2 = \left(\sqrt{(x-5)^2 + (2+7)^2}\right)^2$

$\cancel{x^2} + 2x + 1 + 9 = \cancel{x^2} - 10x + 25 + 81$

$12x = 96$

$x = 8$

06) A(1, 0); B(5, $4\sqrt{3}$); C(x, y)



Medida do lado ℓ

$d_{A,B} = \sqrt{(1-5)^2 + (0-4\sqrt{3})^2} = \sqrt{16+48} = 8$

$d_{C,A} = 8$

$\left(\sqrt{(x-1)^2 + (y-0)^2}\right)^2 = (8)^2$

$x^2 - 2x + 1 + y^2 = 64$

$x^2 + y^2 = 63 + 2x \qquad \text{(I)}$

$d_{C,B} = 8$

$\left(\sqrt{(x-5)^2 + (y-4\sqrt{3})^2}\right)^2 = (8)^2$

$x^2 - 10x + 25 + y^2 - 8\sqrt{3}\,y + 48 = 64$

$x^2 + y^2 = -9 + 10x + 8\sqrt{3}\,y \qquad \text{(II)}$

De I e II, temos:

$-9 + 10x + 8\sqrt{3}\,y = 63 + 2x$

$8x + 8\sqrt{3}y = 72 \quad \div (8)$

$x + \sqrt{3}\,y = 9$

$x = 9 - \sqrt{3}\,y \qquad \text{(III)}$

Substituindo III em I, obtemos:

$x^2 + y^2 = 63 + 2x$

$(9 - \sqrt{3}\,y)^2 + y^2 = 63 + 2 \cdot (9 - \sqrt{3}\,y)$

$\cancel{81} - 18\sqrt{3}\,y + 3y^2 + y^2 = \cancel{63} + \cancel{18} - 2\sqrt{3}\,y$

$4y^2 - 16\sqrt{3}\,y = 0 \quad \div (4)$

$y^2 - 4\sqrt{3}\,y = 0$

$y \cdot (y - 4\sqrt{3}) = 0 \quad \begin{cases} y' = 0 \\ y'' = +4\sqrt{3} \end{cases}$

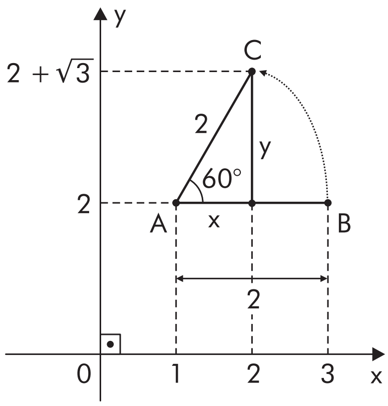
$x = 9 - \sqrt{3}\,y$

Se $y = 0$, $x = 9$ ponto $(9, 0)$ não está no 2º Q.

Se $y = +4\sqrt{3}$, $x = -3$ e $C(-3, 4\sqrt{3})$ está no 2º Q.

07) A

A(1, 2); B(3, 2)



$\cos 60° = \dfrac{x}{2}$

$\dfrac{1}{2} = \dfrac{x}{2}$

$x = 1$

Abcissa de C: $1 + 1 = 2$

$\text{sen } 60° = \dfrac{y}{2}$

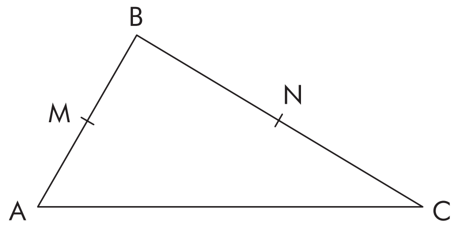
$\dfrac{\sqrt{3}}{2} = \dfrac{y}{2}$

$y = \sqrt{3}$

Ordenada de C: $2 + \sqrt{3}$

$C(2, 2 + \sqrt{3})$

08) A(1, 1); N(5, 4); M(4, 2)



M é ponto médio de $\overline{AB}$.

$x_M = \dfrac{x_A + x_B}{2}$

$4 = \dfrac{1 + x_B}{2}$

$x_B = 7$

$y_M = \dfrac{y_A + y_B}{2}$

$2 = \dfrac{1 + y_B}{2}$

$y_B = 3$

B(7, 3)

N é ponto médio de $\overline{BC}$.

$x_N = \dfrac{x_B + x_C}{2}$

$5 = \dfrac{7 + x_C}{2}$

$x_C = 3$

$y_N = \dfrac{y_B + y_C}{2}$

$4 = \dfrac{3 + y_C}{2}$

$y_C = 5$

C(3, 5)

Baricentro: G

$x_G = \dfrac{x_A + x_B + x_C}{3}$

$x_G = \dfrac{1 + 7 + 3}{3} = \dfrac{11}{3}$

$y_G = \dfrac{y_A + y_B + y_C}{3}$

$y_G = \dfrac{1 + 3 + 5}{3} = 3$

$G\left(\dfrac{11}{3}, 3\right)$

09) B

A(cos x, sen x); B(sen x, –cos x)

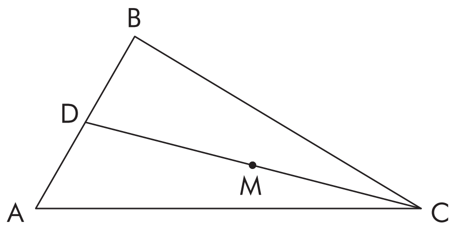
$$d_{A,B} = \sqrt{(\cos x - \operatorname{sen} x)^2 + (\operatorname{sen} x + \cos x)^2}$$

$$= \sqrt{\cos^2 x - \cancel{2\cos x.\operatorname{sen} x} + \operatorname{sen}^2 x + \operatorname{sen}^2 x + \cancel{2\cos x.\operatorname{sen} x} + \cos^2 x}$$

$$= \sqrt{2(\cos^2 x + \operatorname{sen}^2 x)} = \sqrt{2}$$

10) D

A(3, 5); B(–1, 3); C(0, –4)



D é ponto médio de $\overline{AB}$.

$$x_D = \frac{x_A + x_B}{2}$$

$$x_D = \frac{3 - 1}{2} = 1$$

$$y_D = \frac{y_A + y_B}{2}$$

$$y_D = \frac{5 + 3}{2} = 4$$

D(1, 4)

M é ponto médio de $\overline{CD}$.

$$x_M = \frac{x_C + x_D}{2}$$

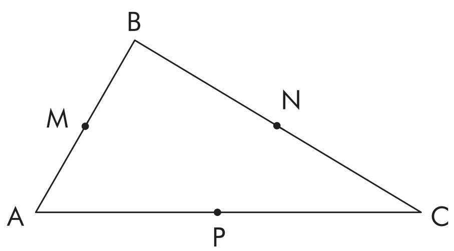
$$x_M = \frac{0 + 1}{2} = \frac{1}{2}$$

$$y_M = \frac{y_C + y_D}{2}$$

$$y_M = \frac{-4 + 4}{2} = 0$$

$$M\left(\frac{1}{2}, 0\right)$$

11) M(–2, 1); N(5, 2); P(2, –3)



$$\frac{x_A + x_B}{2} = x_M$$

$$\frac{x_A + x_B}{2} = -2$$

$x_A + x_B = -4$

$$\frac{x_A + x_C}{2} = x_P$$

$$\frac{x_A + x_C}{2} = 2$$

$x_A + x_C = 4$

$$\frac{x_B + x_C}{2} = x_N$$

$$\frac{x_B + x_C}{2} = 5$$

$x_B + x_C = 10$

$$\begin{cases} x_A + x_B = -4 \\ x_A + x_C = 4 \quad .(-1) \\ x_B + x_C = 10 \quad .(-1) \end{cases}$$

$$\begin{cases} x_A + x_B = -4 \\ -x_A - x_C = -4 \quad \oplus \\ -x_B - x_C = -10 \end{cases}$$

$-2x_C = -18$

$x_C = 9 \Rightarrow x_B = 1;\ x_A = -5$

$$\frac{y_A + y_B}{2} = y_M$$

$$\frac{y_A + y_B}{2} = 1$$

$y_A + y_B = 2$

$$\frac{y_A + y_C}{2} = y_P$$

$$\frac{y_A + y_C}{2} = -3$$

$y_A + y_C = -6$

$$\frac{y_B + y_C}{2} = y_N$$

$$\frac{y_B + y_C}{2} = 2$$

$y_B + y_C = 4$

$$\begin{cases} y_A + y_B = 2 \\ y_A + y_C = -6 \quad .(-1) \\ y_B + y_C = 4 \quad .(-1) \end{cases}$$

$$\begin{cases} y_A + y_B = 2 \\ -y_A - y_C = 6 \quad \oplus \\ -y_B - y_C = -4 \end{cases}$$

$-2y_C = 4$

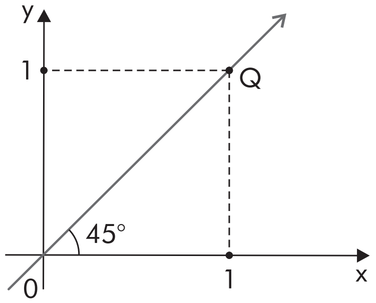
$y_C = -2 \Rightarrow y_B = 6;\ y_A = -4$

A(–5, –4); B(1, 6); C(9, –2)

Soma das coordenadas

–5 – 4 + 1 + 6 + 9 – 2 = 5

12) A



A reta que passa pelos pontos OQ é a bissetriz dos quadrantes ímpares. Para qualquer ponto (x,y) pertencente à bissetriz, o valor de **x** é igual ao de **y**. Portanto, José e Antônio chegam no mesmo horário na diagonal OQ.

13) 1º) Ponto A

A(x, 0); D(–1, –3); E(–2, 4)

$d_{A,D} = d_{A,E}$

$$\left(\sqrt{(x+1)^2+(0+3)^2}\right)^2 = \left(\sqrt{(x+2)^2+(0-4)^2}\right)^2$$

$\cancel{x^2} + 2x + 1 + 9 = \cancel{x^2} + 4x + 4 + 16$

$-2x = 10$

$x = -5$

A(–5, 0)

2º) Ponto B

E(–3, –4); F(–2, 2)

$$\frac{\overline{EB}}{\overline{EF}} = 4$$

$$\frac{x_B - x_E}{x_F - x_E} = 4$$

$$\frac{x_B + 3}{-2 + 3} = 4$$

$x_B = 1$

$$\frac{y_B - y_E}{y_F - y_E} = 4$$

$$\frac{y_B + 4}{2 + 4} = 4$$

$y_B = 20$

B(1, 20)

3º) Ponto C

G(2, 10); H(4, –6)

$$x_C = \frac{2+4}{2} = 3;\ y_C = \frac{10-6}{2} = 2$$

C(3, 2)

4º) Área de ABC

$$D = \begin{vmatrix} -5 & 1 & 3 & -5 \\ 0 & 20 & 2 & 0 \end{vmatrix}$$

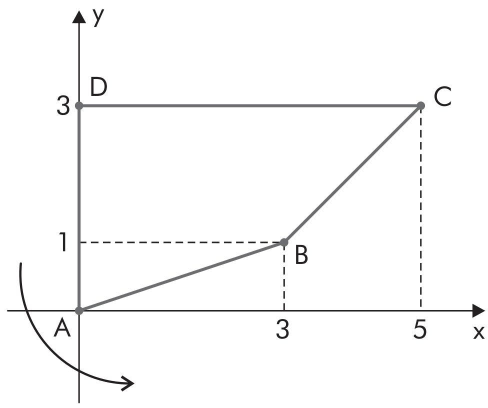
$D = -100 + 2 - 60 + 10$

$D = -148$

$$S = \frac{|-148|}{2} = 74$$

14) A

A(0, 0); B(3, 1); C(5, 3); D(0, 3)



$$D = \begin{vmatrix} 0 & 3 & 5 & 0 & 0 \\ 0 & 1 & 3 & 3 & 0 \end{vmatrix}$$

$D = 9 + 15 - 5$

$D = 19$

$$S = \frac{19}{2} = 9{,}5$$

15) C

$A_T = 4$

A(2, 1)

B(3, –2)

C(x, 0)

$$D = \begin{vmatrix} 2 & 1 & 1 \\ 3 & -2 & 1 \\ x & 0 & 1 \end{vmatrix} = -4 + x + 2x - 3 = 3x - 7$$

$$A_T = \frac{|D|}{2} = 4 \Rightarrow |D| = 8$$

$$|3x - 7| = 8 \begin{cases} 3x - 7 = 8 \Rightarrow x = \dfrac{15}{3} = 5 \\ 3x - 7 = -8 \Rightarrow x = -\dfrac{1}{3} \end{cases}$$

$C\left(-\frac{1}{3}, 0\right)$ ou C(5,0)

16) C

A(1, 4); B(5, 2); C(4, 7)

1º) Ponto M

$$x_M = \frac{x_A + x_B}{2}$$

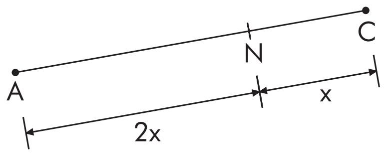
$$x_M = \frac{1+5}{2} = 3$$

$$y_M = \frac{y_A + y_B}{2}$$

$$y_M = \frac{4+2}{2} = 3$$

M(3, 3)

2º) Ponto N: divide $\overline{AC}$ na razão 2.



$$\frac{\overline{AN}}{\overline{NC}} = \frac{2}{1}$$

$$\frac{x_N - x_A}{x_C - x_N} = 2$$

$$\frac{x_N - 1}{4 - x_N} = 2$$

$x_N - 1 = 8 - 2x_N$
$x_N = 3$

$$\frac{y_N - y_A}{y_C - y_N} = 2$$

$$\frac{y_N - 4}{7 - y_N} = 2$$

$y_N - 4 = 14 - 2y_N$
$y_N = 6$
N(3, 6)

3º) Ponto P(x, 0)
M, N e P alinhados

$$\begin{vmatrix} 3 & 3 & x & 3 \\ 3 & 6 & 0 & 3 \end{vmatrix} = 0$$

$18 + 3x - 9 - 6x = 0$
$9 = 3x$
$x = 3$
P(3, 0)

17) C

$$\left.\begin{matrix} (0, 8) \\ (3, 1) \\ (1, y) \end{matrix}\right\} \text{São colineares, então: } D = 0.$$

$$\begin{vmatrix} 0 & 8 & 1 \\ 3 & 1 & 1 \\ 1 & y & 1 \end{vmatrix} = 0$$

$3y + 8 - 1 - 24 = 0$
$3y = 17$

$$y = \frac{17}{3}$$

18) B
A(2, 3); B(3, 4); C(4, 6); D(2, 4); E(3, 8); F(k, 1)

Área de ABC

$$D = \begin{vmatrix} 2 & 3 & 4 & 2 \\ 3 & 4 & 6 & 3 \end{vmatrix}$$

$$= 8 + 18 + \cancel{12} - 9 - 16 - \cancel{12} = 1$$

$$S = \frac{1}{2}$$

Área de DEF

$$D = \begin{vmatrix} 2 & 3 & k & 2 \\ 4 & 8 & 1 & 4 \end{vmatrix} = 16 + 3 + 4k - 12 - 8k - 2$$

$D = -4k + 5$

$$S = \frac{|-4k + 5|}{2}$$

$S_{DEF} = S_{ABC}$

$$\frac{|-4k + 5|}{\cancel{2}} = \frac{1}{\cancel{2}}$$

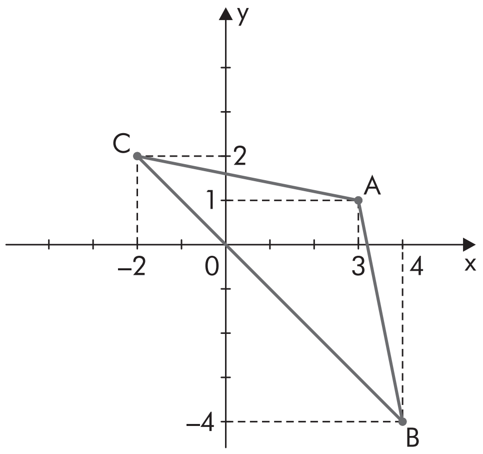
$\Rightarrow \; |-4k + 5| = 1$
$-4k + 5 = 1$
$k = 1$
ou
$-4k + 5 = -1$

$$k = \frac{3}{2}$$

19) A

$$\begin{cases} A(3, 1) \\ B(4, -4) \\ C(-2, 2) \end{cases}$$

Plano cartesiano



$$d_{CB} = \sqrt{(4 + 2)^2 + (-4 - 2)^2} = \sqrt{36 + 36} = \sqrt{72}$$

$$d_{CA} = \sqrt{(3 + 2)^2 + (1 - 2)^2} = \sqrt{25 + 1} = \sqrt{26}$$

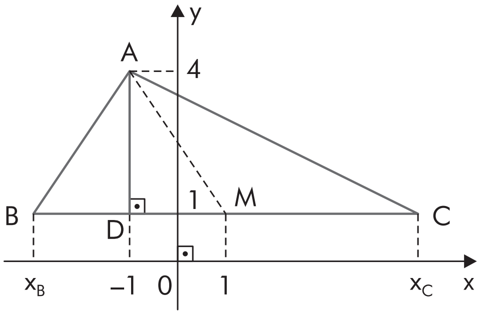
$$d_{AB} = \sqrt{(4 - 3)^2 + (-4 - 1)^2} = \sqrt{1 + 25} = \sqrt{26}$$

Pitágoras

$$(\cancel{\sqrt{72}})^2 \neq (\cancel{\sqrt{26}})^2 + (\cancel{\sqrt{26}})^2$$

$72 \neq 52$
O triângulo tem dois lados iguais; logo, é isósceles.

20)



Note que: $B(x_B, 1)$ e $C(x_C, 1)$.
M(1, 1) é ponto médio.

$$x_M = \frac{x_B + x_C}{2}$$

$$1 = \frac{x_B + x_C}{2}$$

$x_B + x_C = 2$

Pelo desenho, a altura $\overline{AD}$ vale 3.

$$S_{ABC} = \frac{\overline{BC} \cdot 3}{2} = 12$$

$\overline{BC} = 8$

$x_C - x_B = 8$

$$\begin{cases} \cancel{x_B} + x_C = 2 \\ -\cancel{x_B} + x_C = 8 \end{cases} \oplus$$

$2x_C = 10$

$x_C = 5$; $x_B = -3$

B(–3, 1); C(5, 1)

21) A(1, –1); B(2, 3)

$$\begin{vmatrix} 1 & 2 & x & 1 \\ -1 & 3 & y & -1 \end{vmatrix} = 0$$

$3 + 2y - x + 2 - 3x - y = 0$

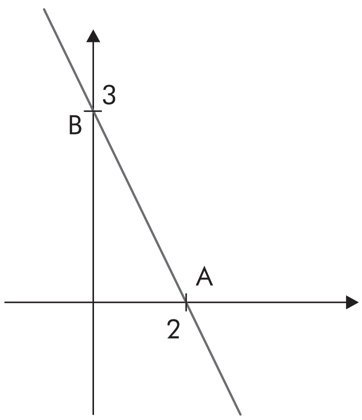
$y - 4x + 5 = 0$

$y = 4x - 5$

Coef. angular = 4

Coef. linear = –5

22)



A(2, 0); B(0, 3)

$$\begin{vmatrix} 2 & 0 & x & 2 \\ 0 & 3 & y & 0 \end{vmatrix} = 0$$

$6 - 3x - 2y = 0 \quad . (-1)$

$3x + 2y - 6 = 0$

23) D

$2x + 3y - 12 = 0$

Onde corta o eixo **x**, temos:

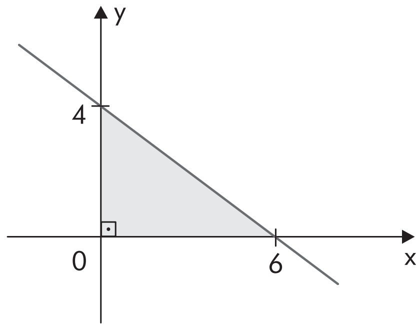
$y = 0 \Rightarrow 2x - 12 = 0 \Rightarrow x = 6$

A(6, 0)

Onde corta o eixo **y**, temos:

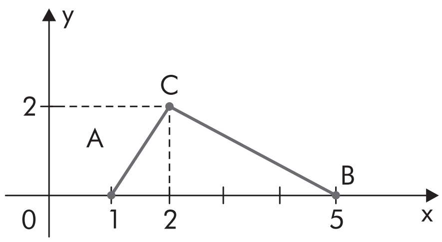
$x = 0 \Rightarrow 3y - 12 = 0 \Rightarrow y = 4$

B(0, 4)



$$S = \frac{6 \cdot 4}{2} = 12$$

24) 10



01. **Incorreto.**
A(1, 0); C(2, 2)

$$m = \frac{y_C - y_A}{x_C - x_A} = \frac{2 - 0}{2 - 1} = 2$$

02. **Correto.**
$\overline{AB} = 4$

04. **Incorreto.**

$$D = \begin{vmatrix} 1 & 5 & 2 & 1 \\ 0 & 0 & 2 & 0 \end{vmatrix} = 10 - 2 = 8$$

$$S = \frac{|D|}{2} = \frac{8}{2} = 4$$

08. **Correto.**
B(5, 0); C(2, 2)

$$\begin{vmatrix} 5 & 2 & x & 5 \\ 0 & 2 & y & 0 \end{vmatrix} = 0$$

$10 + 2y - 2x - 5y = 0$

$-2x - 3y + 10 = 0 \quad . (-1)$

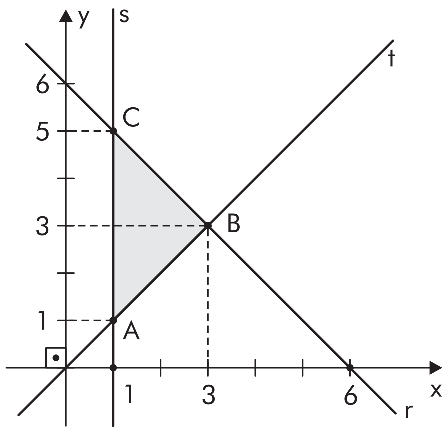
$2x + 3y - 10 = 0$

25) r: $x + y - 6 = 0$

x	y
0	6
6	0

s: $x - 1 = 0 \Rightarrow x = 1$
t: $y = x$

x	y
0	0
1	1



Vértices
A(1, 1)
B é o ponto de encontro de **r** e **t**. Então é solução do sistema:

$$\begin{cases} x + y - 6 = 0 \\ y = x \end{cases}$$

$\Rightarrow x + x - 6 = 0$
$2x = 6$
$x = 3$
$y = 3$
$\Rightarrow$ B(3, 3)
C é o ponto de encontro de **s** e **r**. Logo, C é solução do sistema:

$$\begin{cases} x - 1 = 0 \\ x + y - 6 = 0 \end{cases}$$

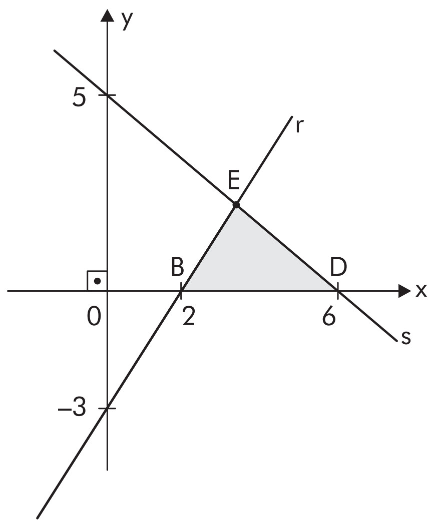
$x = 1$
$\Rightarrow 1 + y - 6 = 0 \Rightarrow y = 5$
$\Rightarrow$ C(1, 5)

Área do triângulo

$$D = \begin{vmatrix} 1 & 3 & 1 & 1 \\ 1 & 3 & 5 & 1 \end{vmatrix} = \cancel{3} + 15 + 1 - \cancel{3} - 3 - 5 = 8$$

$$S = \frac{|8|}{2} = 4$$

26) C



s passa por (6, 0) e (0, 5).

$$\begin{vmatrix} 6 & 0 & x & 6 \\ 0 & 5 & y & 0 \end{vmatrix} = 0$$

$30 - 5x - 6y = 0$
$5x + 6y = 30$

r passa por (0, –3) e (2, 0).

$$\begin{vmatrix} 0 & 2 & x & 0 \\ -3 & 0 & y & -3 \end{vmatrix} = 0$$

$2y - 3x + 6 = 0$
$-3x + 2y = -6$

E é o ponto de encontro de **r** e **s**.

$$\begin{cases} 5x + 6y = 30 \\ -3x + 2y = -6 \quad . (-3) \end{cases}$$

$$\begin{cases} 5x + \cancel{6y} = 30 \\ 9x - \cancel{6y} = 18 \end{cases} \oplus$$

$14x = 48$

$x = \frac{24}{7}$

$5x + 6y = 30$

$5 \cdot \frac{24}{7} + 6y = 30$

$\frac{120}{7} + 6y = 30 \quad \div (6)$

$\frac{20}{7} + y = 5$

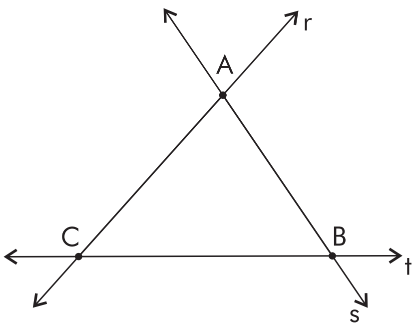
$y = 5 - \frac{20}{7}$

$y = \frac{15}{7}$

$S_{BDE} = \frac{\overset{2}{\cancel{4}} \cdot \frac{15}{7}}{\cancel{2}} = \frac{30}{7}$

27) C

r(x + 3y – 3 = 0)
s(x – 3y – 3 = 0)
t(x = –1)



Ponto A ⇒ r ⋂ s: $\begin{cases} x + 3y = 3 \Rightarrow 3y = 0 \\ \underline{x - 3y = 3} \quad \underline{y = 0} \end{cases}$
$2x \;/\; = 6$
$x = 3$

A(3, 0)

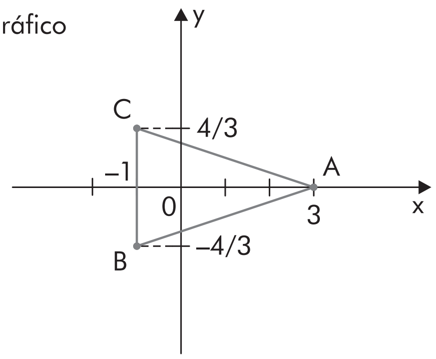
Ponto B ⇒ t ⋂ s: $\begin{cases} x - 3y = 3 \Rightarrow -3y = 4 \\ x = -1 \qquad y = -\frac{4}{3} \end{cases}$

$B\left(-1, -\frac{4}{3}\right)$

Ponto C ⇒ r ⋂ t: $\begin{cases} x + 3y = 3 \Rightarrow 3y = 4 \\ x = -1 \qquad y = \frac{4}{3} \end{cases}$

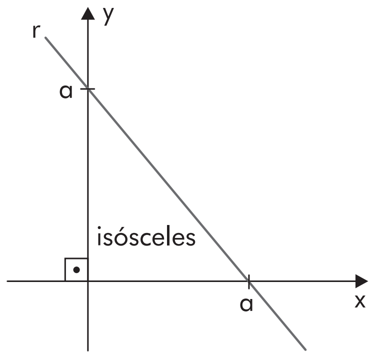
$C\left(-1, \frac{4}{3}\right)$

Gráfico



Graficamente, temos um triângulo isósceles e não retângulo.

28) C



S = 18

$\frac{a \cdot a}{2} = 18$

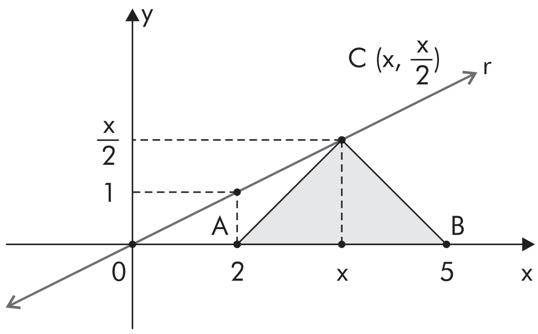
$a^2 = 36 \Rightarrow a = 6$

Segmentária

$\frac{x}{6} + \frac{y}{6} = 1$

x + y = 6

29) C



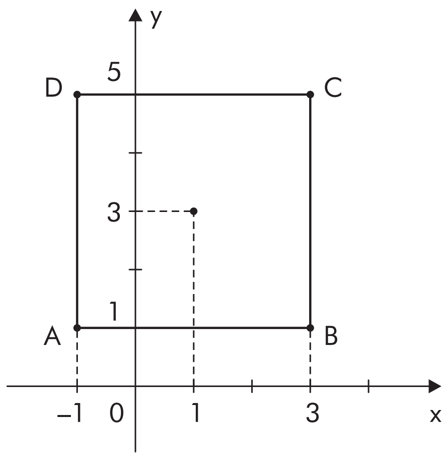
$S_{ABC} = 6$

$\frac{\text{base x altura}}{2} = 6$

$\frac{3 \cdot \frac{x}{2}}{2} = 6$

x = 8 ⇒ y = 4
C(8, 4)

30) 20



01. **Incorreto**.
02. **Incorreto**. A reta que passa por A e B é horizontal, com coeficiente angular zero.
04. **Correto**.
$r: x + y - 4 = 0$
B(3, 1) pertence à **r**, pois 3 + 1 – 4 = 0.
D(–1, 5) pertence à reta, pois –1 + 5 – 4 = 0.

Logo, **r** contém a diagonal $\overline{BD}$.
08. **Incorreto**.
$x + y - 4 = 0$
Fazendo x = 0, temos y = 4.
16. **Correto**. Como o quadrado tem lados paralelos aos eixos **x** e **y**, basta obter os pontos médios dos segmentos.

A e B: $x = \dfrac{3-1}{2} = 1$

B e C: $y = \dfrac{5+1}{2} = 3$

Centro: (1, 3)

31) D
A(10, 25)
B(15, 40)

$$\begin{vmatrix} 10 & 15 & x & 10 \\ 25 & 40 & y & 25 \end{vmatrix} = 0$$

$400 + 15y + 25x - 375 - 40x - 10y = 0$
$-15x + 5y + 25 = 0 \qquad \div (-5)$
$3x - y - 5 = 0$

32) 58
r: (1, 0); (2, –2)

$$\begin{vmatrix} 1 & 2 & x & 1 \\ 0 & -2 & y & 0 \end{vmatrix} = 0$$

$-2 + 2y + 2x - y = 0$
$2x + y - 2 = 0$

01. **Falsa**. Os coeficientes angulares são diferentes.
02. **Verdadeira**.
$m_r = -2$
04. **Falsa**.
$2y - x + 1 = 0$
$2y = x - 1$

$y = \dfrac{x}{2} - \dfrac{1}{2}$

Coeficiente linear $= -\dfrac{1}{2}$
08. **Verdadeira**.

$$\begin{cases} 2x + y = 2 \\ -x + 2y = -1 \quad .\,(2) \end{cases}$$

$$\begin{cases} 2x + y = 2 \\ -2x + 4y = -2 \end{cases}$$

$5y = 0 \Rightarrow y = 0;\ x = 1$
P(1, 0)
16. **Verdadeira**.
P(3, –4)
$r: 2x + y - 2 = 0$
$2 \cdot 3 - 4 - 2 = 0$
$6 - 6 = 0$
32. **Verdadeira**.
$m_r = -2$

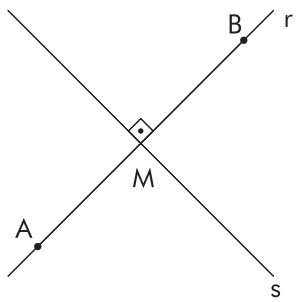
$m_s = \dfrac{1}{2}$

33) A

$$r: \begin{cases} x = -t \Rightarrow t = -x \\ y = 5t \end{cases}$$

$y = 5 \cdot (-x)$
$y = -5x$
$m_r = -5$
s: P(–3, 5); $m_s = -5$
$y - y_0 = m \cdot (x - x_0)$
$y - 5 = -5 \cdot (x + 3)$
$y - 5 = -5x - 15$
$5x + y + 10 = 0$

34) D



A(1, 1); B(9, 3)

r: reta que contém $\overline{AB}$

$m_r = \dfrac{3-1}{9-1} = \dfrac{2}{8} = \dfrac{1}{4}$

Ponto médio de $\overline{AB}$

$x_M = \dfrac{1+9}{2} = 5$

$y_M = \dfrac{1+3}{2} = 2$

M(5, 2)

s: mediatriz de $\overline{AB}$
$m_s = -4$; M(5, 2)
$y - y_0 = m \cdot (x - x_0)$
$y - 2 = -4 \cdot (x - 5)$
$y = -4x + 22$

Intercepta **y** quando x = 0.
y = 22

35) A
B(5, 2); C(1, 5)

A reta que contém $\overline{BC}$ tem coeficiente angular:

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

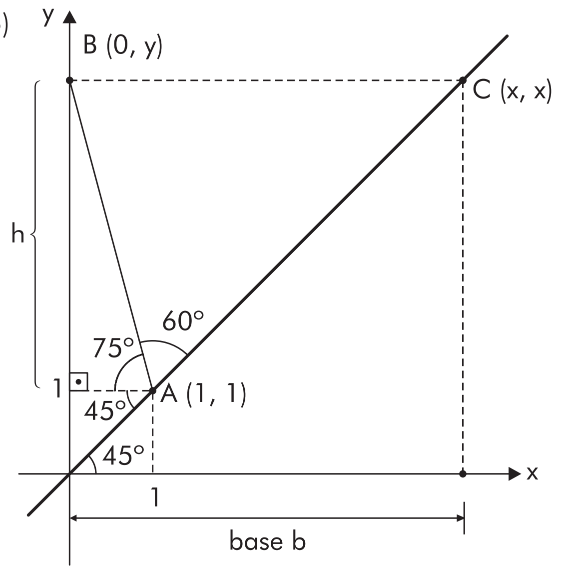
$$m_r = \frac{4}{3};\ A(2, 2)$$

$y - y_0 = m \cdot (x - x_0)$

$$y - 2 = \frac{4}{3} \cdot (x - 2)$$

$3y - 6 = 4x - 8$
$-4x + 3y + 2 = 0 \quad . (-1)$
$4x - 3y - 2 = 0$

36)



$$\text{tg } 75° = \frac{h}{1}$$

$$h = \text{tg } 75° = \text{tg } (30° + 45°) = \frac{\text{tg } 30° + \text{tg } 45°}{1 - \text{tg } 30° \cdot \text{tg } 45°}$$

$$h = \frac{\frac{\sqrt{3}}{3} + 1}{1 - \frac{\sqrt{3}}{3} \cdot 1}$$

$$h = \frac{\frac{\sqrt{3}+3}{\cancel{3}}}{\frac{3-\sqrt{3}}{\cancel{3}}}$$

$$h = \frac{\sqrt{3}+3}{3-\sqrt{3}} \cdot \frac{3+\sqrt{3}}{3+\sqrt{3}}$$

$$h = \frac{3\sqrt{3} + 3 + 9 + 3\sqrt{3}}{9 - 3}$$

$$h = \frac{12 + 6\sqrt{3}}{6}$$

$h = 2 + \sqrt{3}$.

Assim, as coordenadas de B e C são B(0, $3 + \sqrt{3}$) e C($3 + \sqrt{3}$, $3 + \sqrt{3}$).

$$S_{ABC} = \frac{b \cdot h}{2} = \frac{(3+\sqrt{3}) \cdot (2+\sqrt{3})}{2}$$

$$= \frac{6 + 3\sqrt{3} + 2\sqrt{3} + 3}{2} = \frac{9 + 5\sqrt{3}}{2}$$

37) A(6, 2); B(7, 4)

a) $\begin{vmatrix} 6 & 7 & x & 6 \\ 2 & 4 & y & 2 \end{vmatrix} = 0$

$24 + 7y + 2x - 14 - 4x - 6y = 0$
r: $-2x + y + 10 = 0 \quad . (-1)$
$2x - y - 10 = 0$

b) $m_r = 2 \Rightarrow m_s = -\frac{1}{2}$; C(–4, 2)

$y - y_0 = m \cdot (x - x_0)$

$$y - 2 = -\frac{1}{2} \cdot (x + 4)$$

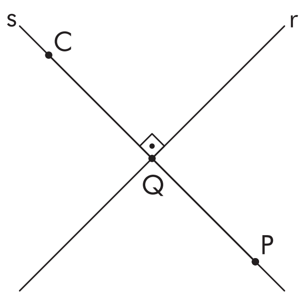
$2y - 4 = -x - 4$
$x + 2y = 0$

c) $\begin{cases} x + 2y = 0 & . (2) \\ -2x + y = -10 \end{cases}$

$\begin{cases} \cancel{2x} + 4y = 0 \\ -\cancel{2x} + y = -10 \end{cases} \oplus$

$5y = -10$
$y = -2$; $x = 4$
Q(4, –2)

d)



Os pontos Q e C pertencem à **s**.

Q é ponto médio de $\overline{PC}$.

$$x_Q = \frac{x_P + x_C}{2}$$

$4 = \dfrac{x_P + (-4)}{2}$

$x_P = 12$

$y_Q = \dfrac{y_P + y_C}{2}$

$-2 = \dfrac{y_P + 2}{2}$

$y_P = -6$

P(12, –6)

38) 13

A(4, 1); B(1, 1); C(4, 5)

r: $x + y - 2 = 0$

01. **Verdadeira.**

$x_M = \dfrac{1+4}{2} = \dfrac{5}{2}$

$y_M = \dfrac{1+5}{2} = 3$

$M\left(\dfrac{5}{2}, 3\right)$

02. **Falsa.**

C(4, 5); O(0, 0)

$d_{C,O} = \sqrt{4^2 + 5^2} = \sqrt{41}$

04. **Verdadeira.**

A(4, 1); B(1, 1)

$$\begin{vmatrix} 4 & 1 & x & 4 \\ 1 & 1 & y & 1 \end{vmatrix} = 0$$

$4 + y + \cancel{x} - 1 - \cancel{x} - 4y = 0$

$-3y + 3 = 0 \quad \div (-3)$

$y - 1 = 0$

08. **Verdadeira.**

r: $x + y = -2 \Rightarrow m_r = -1$

s: $-5x + 5y - 13 = 0 \Rightarrow m_s = 1$

16. **Falsa.**

A(4, 1)

r: $x + y - 2 = 0$

$4 + 1 - 2 = 0$

$3 = 0$ (absurdo)

39) P(6, –1)

r: $6x - 8y - 19 = 0$

a) $m_r = \dfrac{6}{8} = \dfrac{3}{4}$

b) $m_s = -\dfrac{4}{3}$; P(6, –1)

$y - y_0 = m \, . \, (x - x_0)$

$y + 1 = -\dfrac{4}{3} \, . \, (x - 6)$

$3y + 3 = -4x + 24$

$4x + 3y - 21 = 0$

c) $\begin{cases} 4x + 3y - 21 = 0 & .(-3) \\ 6x - 8y - 19 = 0 & .(2) \end{cases}$

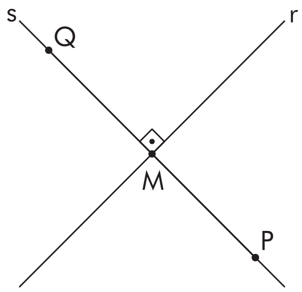
$\begin{cases} -\cancel{12x} - 9y + 63 = 0 \\ \cancel{12x} - 16y - 38 = 0 \end{cases}$

$-25y + 25 = 0$

$y = 1; \; x = \dfrac{9}{2}$

$M\left(\dfrac{9}{2}, 1\right)$

d)



$x_M = \dfrac{x_P + x_Q}{2}$

$\dfrac{9}{2} = \dfrac{6 + x_Q}{2}$

$x_Q = 3$

$y_M = \dfrac{y_P + y_Q}{2}$

$1 = \dfrac{-1 + y_Q}{2}$

$y_Q = 3$

Q(3, 3)

e) $d_{P,Q} = \sqrt{(6-3)^2 + (-1-3)^2} = \sqrt{9 + 16} = 5$

40) E

$\begin{cases} 2x + 3y - 8 = 0 & .(-5) \\ 5x + 7y - 19 = 0 & .(2) \end{cases}$

$\begin{cases} -\cancel{10x} - 15y + 40 = 0 \\ \cancel{10x} + 14y - 38 = 0 \end{cases} \oplus$

$-y + 2 = 0$

$y = 2; \; x = 1$

P(1, 2)

r: $x - 3y + 2 = 0 \Rightarrow m_r = \dfrac{1}{3}$

s: P(1, 2); $m_s = -3$

$y - y_0 = m \, . \, (x - x_0)$

$y - 2 = -3 \, . \, (x - 1)$

$3x + y - 5 = 0$

41) 15

r: $kx + 5y - 7 = 0$

s: $4x + ky - 5 = 0$

01. **Verdadeira**.
A(1, –2)
$k \cdot 1 + 5 \cdot (-2) - 7 = 0$
$k = 17$

02. **Verdadeira**.
$\left(0, \frac{7}{5}\right)$ pertence à **r**, pois:

$k \cdot 0 + \cancel{5} \cdot \frac{7}{\cancel{5}} - 5 = 0$

Se $\left(0, \frac{7}{5}\right)$ pertence à **s**, então:

$4 \cdot 0 + k \cdot \frac{7}{5} - 5 = 0$

$k = \frac{25}{7}$

04. **Verdadeira**.
Para $k = 2\sqrt{5}$,

r: $2\sqrt{5}\,x + 5y - 7 = 0 \Rightarrow m_r = -\frac{2\sqrt{5}}{5}$

s: $4x + 2\sqrt{5}\,y - 5 = 0 \Rightarrow m_s = \frac{-4}{2\sqrt{5}} = -\frac{2\sqrt{5}}{5}$

$m_r = m_s$

08. **Verdadeira**.
P(2, 1) pertence à **s**.
$4 \cdot 2 + k \cdot 1 - 5 = 0$
$k = -3$

s: $4x - 3y - 5 = 0 \Rightarrow m_s = \frac{4}{3}$

t passa por (2, 1) e é perpendicular à **s**.

$m_t = -\frac{3}{4}$

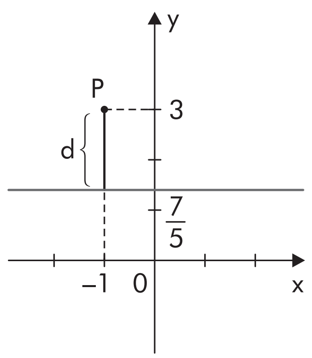
$y - y_0 = m \cdot (x - x_0)$

$y - 1 = -\frac{3}{4} \cdot (x - 2)$

$4y - 4 = -3x + 6$
$3x + 4y - 10 = 0$

16. **Falsa**.
$k = 0$
r: $0 \cdot x + 5y - 7 = 0$

$y = \frac{7}{5}$



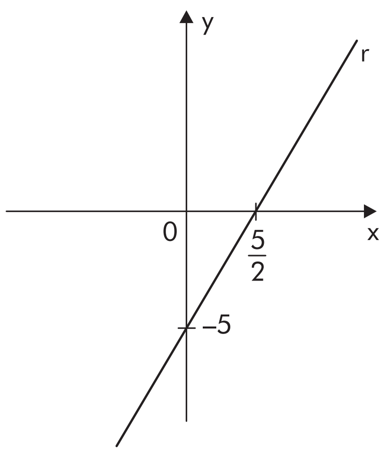
$d = 3 - \frac{7}{5}$

$d = \frac{8}{5}$

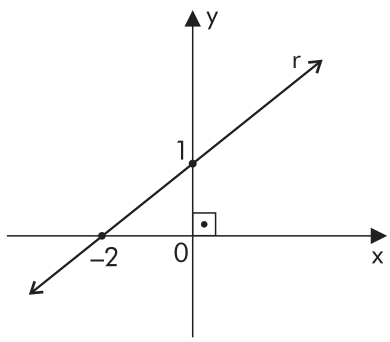
42) B
r: $2x - y - 5 = 0$
I. **Verdadeira**.
P(0, –5): $2 \cdot 0 - (-5) - 5 = 0$
$m_r = 2$
s: $2x - y = 0$
$m_s = 2$
$m_r = m_s$
II. **Verdadeira**.
P(1, –3): $2 \cdot 1 - (-3) - 5 = 0$
Q(3, 1): $2 \cdot 3 - 1 - 5 = 0$
III. **Verdadeira**.
$m_r = 2$
s: $x + 2y - 5 = 0$

$m_s = -\frac{1}{2}$

IV. **Verdadeira**.
r: $2x - y - 5 = 0$
$y = 2x - 5$
Coeficiente angular = $2 > 0$.
Função crescente.
V. **Falsa**.



43) C



Reta **r**

$\frac{x}{-2} + \frac{y}{1} = 1$

$x - 2y = -2$

$-2y = -2 - x$
$2y = x + 2$

$y = \frac{x}{2} + 1$

I. **Verdadeira**. Raiz $\Rightarrow$ $x = -2$

II. **Verdadeira**. $y = \frac{x}{2} + 1$

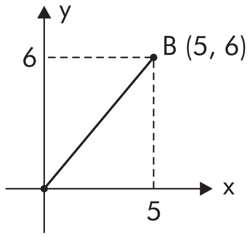
III. **Verdadeira**. Crescente.

IV. **Falsa**. $f(0) = -2 \Rightarrow f(0) = \frac{0}{2} + 1 = 1$

V. **Falsa**. $y = -2x + 1$

44) D

Planta A



$$\begin{vmatrix} 0 & 5 & x & 0 \\ 0 & 6 & y & 0 \end{vmatrix} = 0$$

$5y - 6x = 0 \quad . (-1)$
$6x - 5y = 0$

45) E

$$\begin{cases} 2x - y = 0 & . (2) \\ 5x + 2y + 27 = 0 \end{cases}$$

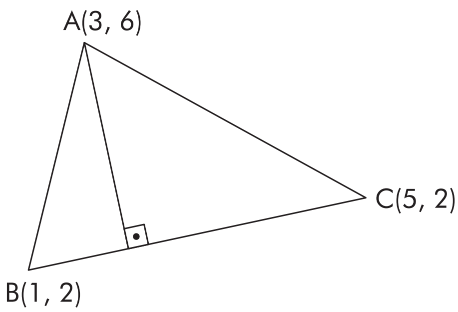
$$\begin{cases} 4x - \cancel{2y} = 0 \\ 5x + \cancel{2y} = -27 \end{cases} \oplus$$

$9x = -27$
$x = -3;\ y = -6$
Soma: $-3 - 6 = -9$

46) D

$P(-1, 1);\ m = 5$
$y - 1 = 5(x + 1)$
$y = 5x + 6$
$5x - y + 6 = 0$

47) B



Reta que contém $\overline{BC}$.

$$\begin{vmatrix} 1 & 5 & x & 1 \\ 2 & 2 & y & 2 \end{vmatrix} = 0$$

$2 + 5y + \cancel{2x} - 10 - \cancel{2x} - y = 0$

$0x + 4y - 8 = 0$

A altura relativa ao lado $\overline{BC}$ é dada por:

$$h = d_{A,\overline{BC}} = \frac{|0\ .\ 3 + 4\ .\ 6 - 8|}{\sqrt{0^2 + 4^2}} =$$

$$= \frac{16}{4} = 4$$

48) Reta que passa por (4, 0) e (0, 8).

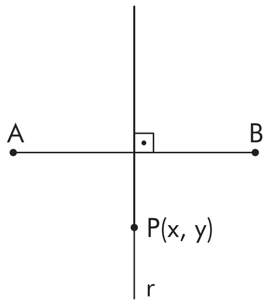
$$\begin{vmatrix} 4 & 0 & x & 4 \\ 0 & 8 & y & 0 \end{vmatrix} = 0$$

$32 - 8x - 4y = 0 \quad \div (4)$
$8 - 2x - y = 0$
$y = 8 - 2x$

Intersecção

$$\begin{cases} y = 8 - 2x \\ y = 8x - 2x^2 \end{cases}$$

$8 - 2x = 8x - 2x^2$
$2x^2 - 10x + 8 = 0 \quad \div (2)$
$x^2 - 5x + 4 = 0$
$x' = 1 \Rightarrow y' = 6$
$x'' = 4 \Rightarrow y'' = 0$
A(1, 6); B(4, 0)



A mediatriz do segmento AB é a reta **r** formada pelos pontos P(x, y) equidistantes de A e B.

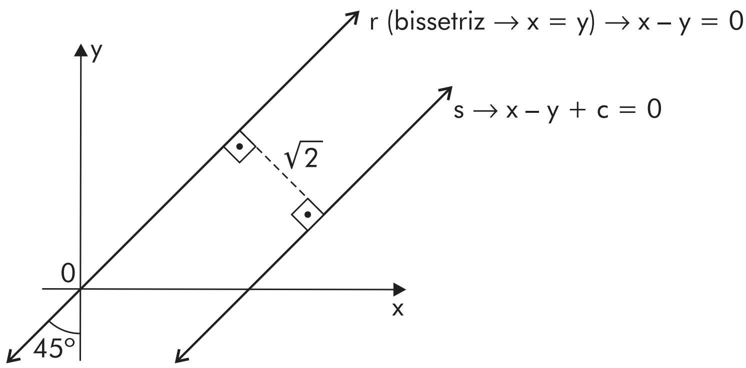
$d_{P,A} = d_{P,B}$

$$\left(\sqrt{(x-1)^2 + (y-6)^2}\right)^2 = \left(\sqrt{(x-4)^2 + y^2}\right)^2$$

$$\cancel{x^2} - 2x + 1 + \cancel{y^2} - 12y + 36 = \cancel{x^2} - 8x + 16 + \cancel{y^2}$$

$6x - 12y + 21 = 0 \quad \div (3)$
$2x - 4y + 7 = 0$

49) E



$$d_{sr} = \left|\frac{C_s - C_r}{\sqrt{A^2 + B^2}}\right| = \left|\frac{C - 0}{\sqrt{1+1}}\right| = \sqrt{2}$$

$$\left|\frac{C}{\sqrt{2}}\right| = \sqrt{2} \quad \begin{cases} \frac{C}{\sqrt{2}} = \sqrt{2} \Rightarrow C = 2 \\ \frac{C}{\sqrt{2}} = -\sqrt{2} \Rightarrow C = -2 \end{cases}$$

$x - y + 2 = 0$ ou $x - y - 2 = 0$
$x - y = -2$ ou $x - y = 2$

50) D
$A(2, 1)$
$r(x - y + 1 = 0)$
1) **Verdadeira.**
$s \,//\, r$
$m_s = m_r = 1$
$y - 1 = 1(x - 2)$
$y - 1 = x - 2$
$x - y - 1 = 0$
2) **Verdadeira.**

$$\left.\begin{matrix} r \cap \text{eixo } x \Rightarrow y = 0 \\ x - y + 1 = 0 \Rightarrow x = -1 \end{matrix}\right\} \text{Ponto } (-1, 0)$$

3) **Falsa.**
$r(x - y + 1 = 0)$
$t\,(x + y + 3 = 0)$

$$\begin{cases} x - y = -1 \\ x + y = -3 \end{cases} \Rightarrow y = -3 + 2$$
$$2x \;/\; = -4 \qquad y = -1$$
$$x = -2$$

$P(-2, -1)$
4) **Falsa.**
$z \perp r$

$$m_z = \frac{-1}{m_r} = \frac{-1}{1} = -1$$

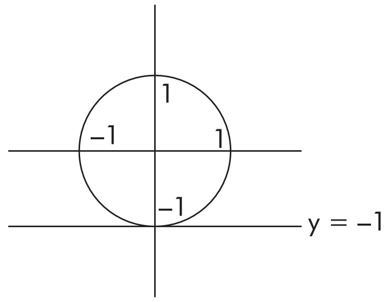
$y - 1 = -1(x - 2)$
$y - 1 = -x + 2$
$x + y - 3 = 0$

$$\begin{cases} x - y = -1 \\ x + y = 3 \end{cases} \Rightarrow y = 2 \qquad (1, 2)$$
$$2x \;/\; = 2 \quad \Rightarrow x = 1$$

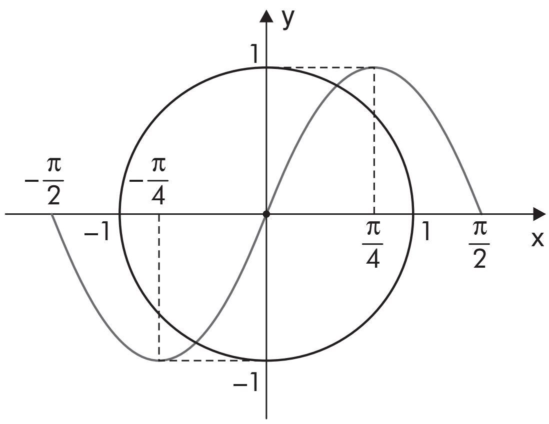
51) 46
$C(0, 0);\ R = 1$
$(x - 0)^2 + (y - 0)^2 = 1$
$x^2 + y^2 = 1$
01. **Incorreto.**
$x^2 + y^2 - 1 = 0$
02. **Correto.**
$P(\cos\alpha, \text{sen}\,\alpha)$ satisfaz a equação, pois $\cos^2\alpha + \text{sen}^2\alpha = 1$.
04. **Correto.**

$$\begin{cases} y = x + 1 \\ x^2 + y^2 = 1 \end{cases}$$

$x^2 + (x + 1)^2 = 1$
$x^2 + x^2 + 2x + \not{1} = \not{1}$
$2x^2 + 2x = 0 \quad \div(2)$
$x^2 + x = 0$
$x' = 0;\ x'' = -1$
$x = 0 \Rightarrow y = 1$
$x = -1 \Rightarrow y = 0$
$A(0, 1);\ B(-1, 0)$
08. **Correto.**
$y + 1 = 0 \Rightarrow y = -1$

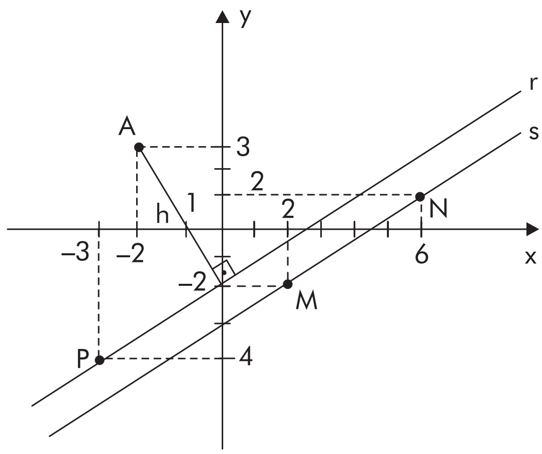


16. **Incorreto.**
$E = x^2 + y^2 - 1;\ P(1, 1)$
$E = 1^2 + 1^2 - 1$
$E = 1 > 0$
ponto exterior
32. **Correto.**
$y = \text{sen}\,2x$



Intercepta o eixo **x** uma única vez, no ponto $P(0, 0)$.

52) $A(-2, 3)$



Coeficiente angular de **s**
M(2, –2); N(6, 1)

$m_s = \dfrac{-2-1}{2-6} = \dfrac{3}{4}$

Coeficiente angular de **r**

$m_r = m_s = \dfrac{3}{4}$; P(–3, –4)

Equação de **r**

$y + 4 = \dfrac{3}{4}(x + 3)$

$4y + 16 = 3x + 9$
$-3x + 4y + 7 = 0$

A altura **h** do triângulo é dada por $h = d_{A,\,r}$

$h = \dfrac{|-3\,.\,(-2) + 4\,.\,3 + 7|}{\sqrt{9+16}}$

$h = \dfrac{25}{5}$

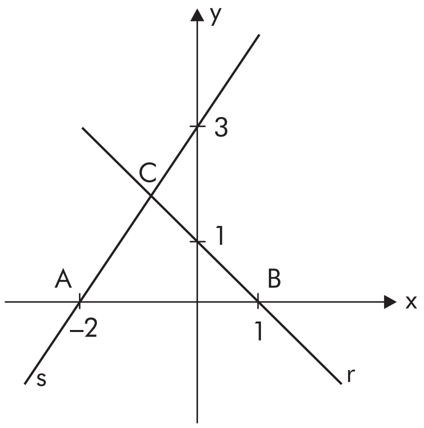
$h = 5$

53) r: $x + y - 1 = 0$
s: $x + y + 3 = 0$
Vamos obter um ponto P de **s** e calcular sua distância à **r**.
$x = 0 \Rightarrow y = -3 \Rightarrow P(0, -3)$

$d_{P,r} = \dfrac{|1\,.\,0 + 1\,.\,(-3) - 1|}{\sqrt{1+1}}$

$= \dfrac{4}{\sqrt{2}}\,.\,\dfrac{\sqrt{2}}{\sqrt{2}} = 2\sqrt{2}$

54) 09



01. **Verdadeira**.

$\begin{vmatrix} -2 & 0 & x & -2 \\ 0 & 3 & y & 0 \end{vmatrix} = 0$

$-6 - 3x + 2y = 0 \quad .\,(-1)$
s: $3x - 2y + 6 = 0$

02. **Falsa**.

s: $3x - 2y + 6 = 0 \Rightarrow m_s = \dfrac{3}{2}$

r: $\begin{vmatrix} 0 & 1 & x & 0 \\ 1 & 0 & y & 1 \end{vmatrix} = 0$

$y + x - 1 = 0$
r: $x + y - 1 = 0 \Rightarrow m_r = -1$

04. **Falsa**.

$\begin{cases} x + y - 1 = 0 & .\,(2) \\ 3x - 2y + 6 = 0 \end{cases}$

$\begin{cases} 2x + \cancel{2y} - 2 = 0 \\ 3x - \cancel{2y} + 6 = 0 \end{cases} \oplus$

$5x + 4 = 0$

$x = -\dfrac{4}{5}$

Observação: Pelo gráfico já se pode perceber que a abcissa do ponto de encontro é negativa.

08. **Verdadeira**.
Origem: P(0, 0)
r: $x + y - 1 = 0$

$d_{P,\,r} = \dfrac{|1\,.\,0 + 1\,.\,0 - 1|}{\sqrt{1+1}} = \dfrac{1}{\sqrt{2}} = \dfrac{\sqrt{2}}{2}$

16. **Falsa**.
Base = $\overline{AB}$ = 3
Altura = ordenada do ponto C
r: $x + y - 1 = 0$

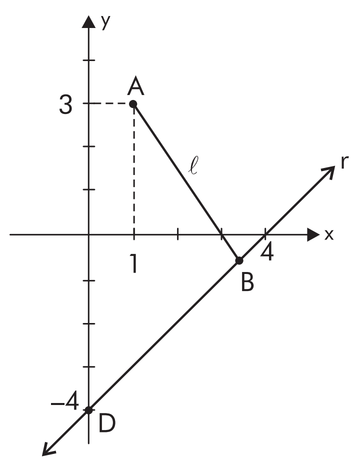
$x = -\dfrac{4}{5} \Rightarrow -\dfrac{4}{5} + y - 1 = 0$

$y = \dfrac{9}{5}$

$S = \dfrac{3\,.\,\frac{9}{5}}{2}$

$S = \dfrac{27}{10}$

55) A(1, 3)
r: $x - y - 4 = 0$



O lado ℓ é dado por $\ell = d_{A,\,r}$.

$\ell = \dfrac{|1\,.\,1 - 1\,.\,3 - 4|}{\sqrt{1+1}} = \dfrac{6}{\sqrt{2}} = 3\sqrt{2}$

Área = $(3\sqrt{2})^2 = 18$

56) 14

r: $y - 2x + \sqrt{5} = 0$; $m_r = 2$

s: $y + 1 = 0$; $m_s = 0$

t: $x + 2y + 6 = 0$; $m_t = -\dfrac{1}{2}$

01. **Incorreta**.

$m_r \neq m_s$

02. **Correta**.

$m_r = \dfrac{-1}{m_t}$

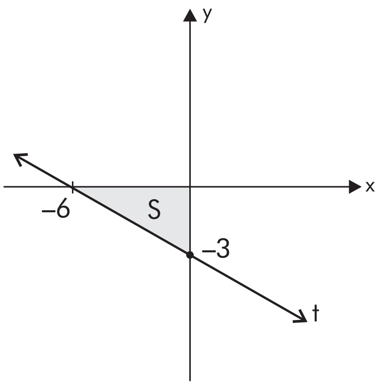
04. **Correta**.

Origem: P(0, 0)

r: $-2x + y + \sqrt{5} = 0$

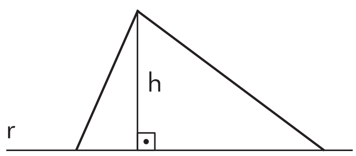
$$d_{P,r} = \frac{|-2 \cdot 0 + 1 \cdot 0 + \sqrt{5}|}{\sqrt{4+1}} = \frac{\sqrt{5}}{\sqrt{5}} = 1$$

08. **Correta**.



$$S = \frac{6 \cdot 3}{2} = 9$$

57)



h é a distância entre A e a reta **r** que contém $\overline{BC}$.

$$r: \begin{vmatrix} -1 & 2 & x & -1 \\ 3 & 7 & y & 3 \end{vmatrix} = 0$$

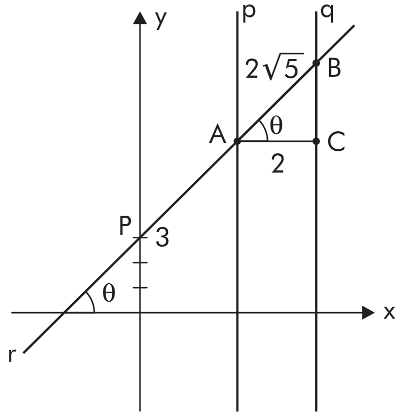
$-7 + 2y + 3x - 6 - 7x + y = 0$

$-4x + 3y - 13 = 0$

$h = d_{A,r}$

$$h = \frac{|-4 \cdot (1) + 3 \cdot (-1) - 13|}{\sqrt{16+9}} = \frac{20}{5} = 4$$

58) B



P(0, 3)

No triângulo ABC,

$(2\sqrt{5})^2 = 2^2 + \overline{BC}^2$

$20 = 4 + \overline{BC}^2$

$\overline{BC} = 4$.

$$m_r = \text{tg } \theta = \frac{\overline{BC}}{\overline{AC}} = \frac{4}{2} = 2$$

Assim, $y - y_0 = m(x - x_0)$

$y - 3 = 2 \cdot (x - 0)$

$y = 2x + 3$

59) C

$$\text{Ponto A}: \begin{cases} x - y = 4 \\ x + y = -2 \end{cases} \rightarrow y = -2 - 1$$

$2x \;/ = 2 \qquad y = -3$

$x = 1 \qquad A(1, -3)$

Ponto B: $x - y - 4 = 0 \cap$ eixo x $\rightarrow y = 0$

$x = 4 \qquad B(4, 0)$

Ponto C: $x + y + 2 = 0 \cap$ eixo x $\rightarrow y = 0$

$x = -2 \qquad C(-2, 0)$

$$D = \begin{vmatrix} 1 & 4 & -2 & 1 \\ -3 & 0 & 0 & -3 \end{vmatrix} = 6 + 12 = 18$$

$$A_T = \frac{|18|}{2} = 9$$

60) 15

Reta r_1: (1, 2) e $\left(\dfrac{3}{5}, \dfrac{6}{5}\right)$

$$\begin{vmatrix} 1 & \frac{3}{5} & x & 1 \\ 2 & \frac{6}{5} & y & 2 \end{vmatrix} = 0$$

$$\frac{6}{5}+\frac{3}{5}y+2x-\frac{6}{5}-\frac{6}{5}x-y=0$$

$6 + 3y + 10x - 6 - 6x - 5y = 0$

$4x - 2y = 0 \quad \div (2)$

$2x - y = 0$

Reta r_2: (1, 1) e $\left(\frac{3}{5}, \frac{6}{5}\right)$

$$\begin{vmatrix} 1 & \frac{3}{5} & x & 1 \\ 1 & \frac{6}{5} & y & 1 \end{vmatrix} = 0$$

$$\frac{6}{5}+\frac{3}{5}y+x-\frac{3}{5}-\frac{6}{5}x-y=0$$

$6 + 3y + 5x - 3 - 6x - 5y = 0$

$-x - 2y + 3 = 0 \quad . (-1)$

$x + 2y - 3 = 0$

01. **Correto**.

02. **Correto**. $m_{r_1} = 2$ e $m_{r_2} = \frac{-1}{2}$

04. **Correto**.

08. **Correto**. $m = 2$ e $m_{r_1} = 2$