

RESPOSTAS

CONJUNTOS

Exercícios propostos

1. a) \in c) \notin e) \in
b) \notin d) \in f) \notin

2. a) abreviadamente:

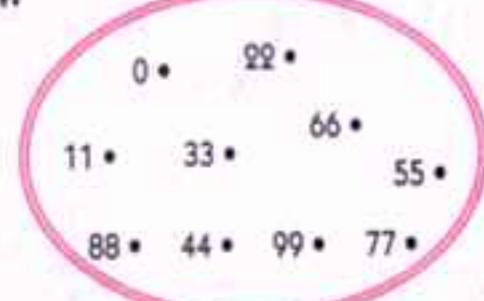
$A = \{x \mid x \text{ é consoante do nosso alfabeto}\}$
por extenso:
 $A = \{b, c, d, f, g, h, j, l, m, n, p, q, r, s, t, v, x, z\}$

b) abreviadamente:

$A = \{x \mid x \text{ é múltiplo de } 5 \text{ e } x \geq 0\}$
por extenso:
 $A = \{0, 5, 10, 15, 20, \dots\}$

3. a) \neq b) \neq c) $=$ d) $=$

4.



5. a) \emptyset b) C c) \emptyset d) C

6. a) \emptyset b) C c) \emptyset d) C

7. a) $A \cup B = \{a, e, i, o, u\}$
b) $A \cup C = \{a, e, i, o, u\}$
c) $B \cup C = \{a, e, i, o, u\}$
d) $A \cap B = \{a, e, i\}$
e) $A \cap C = \{o, u\}$
f) $B \cap C = \emptyset$

8. a) $\{-2, -3, -4\}$
b) $\{0, -1\}$
c) \emptyset
d) \emptyset

9. a) {núcleo}

b) {membrana celular, citoplasma}

c) \emptyset

d) \emptyset

10. e 11. c 12. b

13. a) $A = \{0, 1, 2, 3, 4\}$

b) $B = \{5, 6, 7, 8, 9\}$

c) $C = \{2, 4, 6, \dots\}$

d) $D = \{11, 26, 47, 74\}$

14. a) $y = 9$ b) $y = 10$

15. 75

16. a) $V = \{3\}$ d) $V = \{6\}$

b) $V = \{5\}$ e) $V = \{2\}$

c) $V = \emptyset$ f) $V = \emptyset$

17. infinitas

18. 7, 9 e 11

19. a) $5 \in \mathbb{N}$ c) $8 \in \mathbb{N}$

b) $5 \in \mathbb{N}$ d) $\frac{13}{2} \notin \mathbb{N}$

20. sim, pois $30 \in \mathbb{N}$

21. 6 cm^2

22. 540 anos

23. e

24. $N = 47$

25. c

26. a) \in d) \notin g) \in

b) \notin e) \in h) \notin

c) \notin f) \in

27. a) 0 c) 70π

b) 55 d) -12

28. e

29. a) $V = \{\pm 3\}$

b) $V = \{-3, 2\}$

c) $V = \{1\}$

d) $V = \emptyset$

e) $V = \{-3, 2\}$

30. 2

31. 11, 12 e 13

32. 8, 10 e 12

33. a) $\frac{11}{12}$ d) $\frac{29}{10}$

b) $\frac{11}{15}$ e) 0

c) $\frac{9}{10}$ f) $-\frac{11}{5}$

34. a) $-\frac{1}{15}$ b) 0,05

35. b 36. 3000 37. b

38. $\frac{3}{5}$ 39. b 40. -140

41. $\frac{10}{11}$ 42. $\frac{29}{20}$ 43. -10,1

44. a) $V = \left\{-\frac{3}{4}\right\}$ d) $V = \{1\}$

b) $V = \{5\}$ e) $V = \{0\}$

c) $V = \left\{-\frac{9}{3}\right\}$

45. d 46. 1 47. e

48. d 49. d

50. a) \in c) \notin e) \notin g) \in

b) \in d) \in f) \in h) \in

51. a) V d) V g) V j) V

b) F e) F h) V

c) V f) V i) F

52. a) $A = \{0, 1, 2, 3, 4\}$

b) $B = \{2, 3, 4, 5\}$

c) $C = \{-3, -2, -1, 0, 1, \dots\}$

d) $D = \{-3, -2, -1, 1\}$

53. demonstração

54. d 55. e

56. a) $27 - 10\sqrt{2}$

b) 22

c) 12,4

d) 62

e) -47

f) $\sqrt{2} - \sqrt{3} - \sqrt{6} + 1$

g) $-5\sqrt{6} - 2\sqrt{2} - 3\sqrt{3} - 1$

h) $m + 2x\sqrt{2} - x^2 - 2$

57. a) $2\sqrt{2}$

b) $\sqrt{3} - \sqrt{2}$

c) $\frac{9 + 2\sqrt{14}}{5}$

58. a

59. e

60. $\frac{2 + \sqrt{2} + \sqrt{6}}{4}$

61. b

62. a)

b)

c)

d)

e)

f)

g)

h)

i)

j)

l)

m)

63. a) $[-4, 7] =$

= $\{x \in \mathbb{R} \mid -4 \leq x \leq 7\}$

b) $]2, 5[=$

= $\{x \in \mathbb{R} \mid 2 < x < 5\}$

c) $[1, 3[=$

= $\{x \in \mathbb{R} \mid 1 \leq x < 3\}$

d) $]-\infty, -1] =$

= $\{x \in \mathbb{R} \mid x \leq -1\}$

e) $]7, +\infty[=$

= $\{x \in \mathbb{R} \mid x > 7\}$

f) $]-\infty, +\infty[= \mathbb{R}$

g) $]-1, 1[=$

= $\{x \in \mathbb{R} \mid -1 < x < 1\}$

h) $]0, +\infty[=$

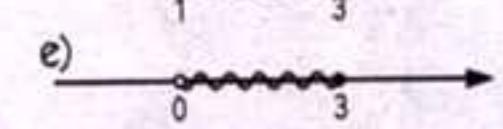
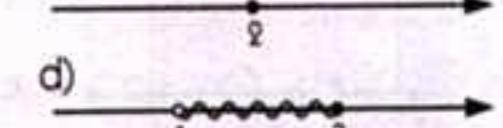
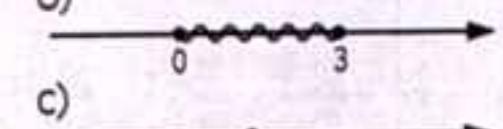
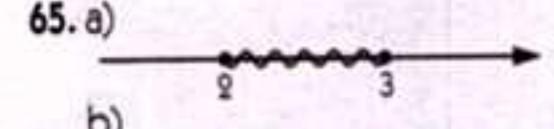
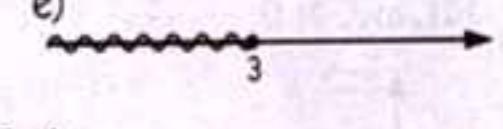
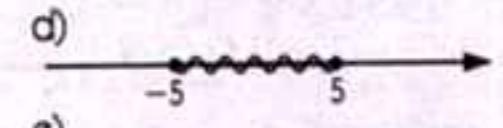
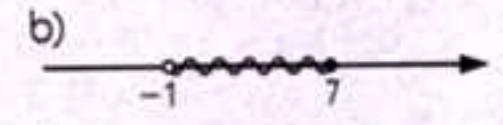
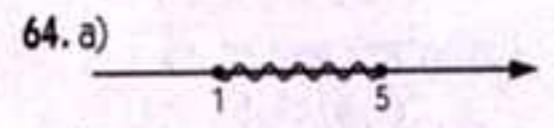
= $\{x \in \mathbb{R} \mid x \geq 0\}$

i) $]-\infty, -\sqrt{5}] =$
= $\{x \in \mathbb{R} \mid x \leq -\sqrt{5}\}$

j) $[\sqrt{5}, +\infty[=$
= $\{x \in \mathbb{R} \mid x \geq \sqrt{5}\}$

l) $]-100, 100] =$
= $\{x \in \mathbb{R} \mid -100 < x \leq 100\}$

m) $]-\infty, \frac{3}{4}[=$
= $\{x \in \mathbb{R} \mid x \leq \frac{3}{4}\}$



Exercícios complementares

66. a) \in d) \in g) \notin j) \in
b) \notin e) \notin h) \in
c) \notin f) \in i) \in

67. a) F c) V e) V
b) V d) F f) V

68. c 69. c 70. c

71. b 72. d 73. d

74. c

75. a) $A = \{0, 1, 2, 3, 4\}$

- b) $B = \{3, 4, 5, 6\}$

- c) $C = \{-2, -1\}$

91. 62 92. a 93. c
 94. -10,1 95. a) 2²¹
 b) 7
 96. c 97. e 98. b

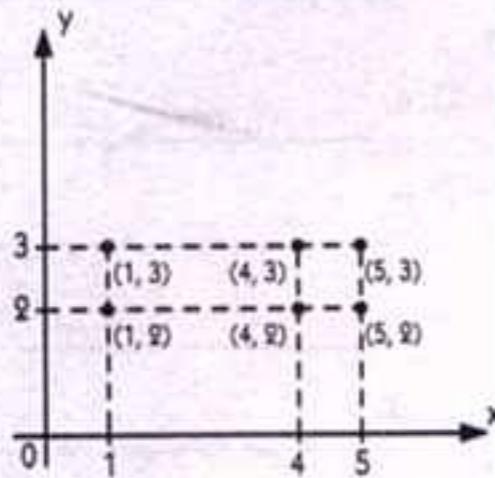
FUNÇÕES

Exercícios propostos

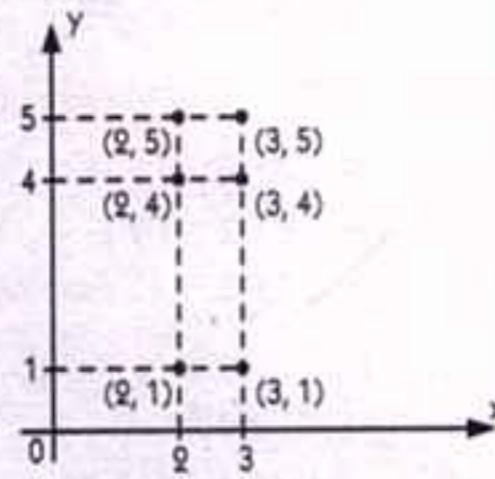
99. a) $A \times B = \{(3,1), (3,4), (5,1), (5,4), (6,1), (6,4)\}$
 b) $B \times A = \{(1,3), (1,5), (1,6), (4,3), (4,5), (4,6)\}$

100. a) $E \times F = \{(0,4), (0,5), (1,4), (1,5), (2,4), (2,5)\}$
 b) $F \times E = \{(4,0), (4,1), (4,2), (5,0), (5,1), (5,2)\}$
 c) $F \times G = \{(4,-1), (4,0), (5,-1), (5,0)\}$
 d) $E \times G = \{(0,-1), (0,0), (1,-1), (1,0), (2,-1), (2,0)\}$

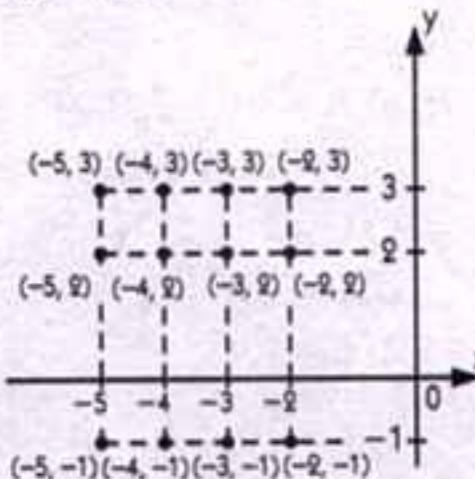
101. a) $C \times D$



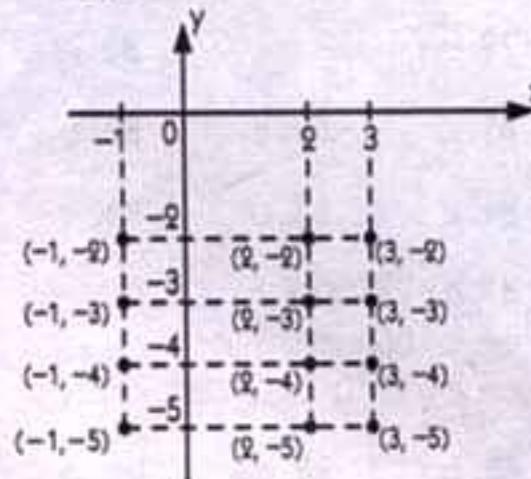
- b) $D \times C$



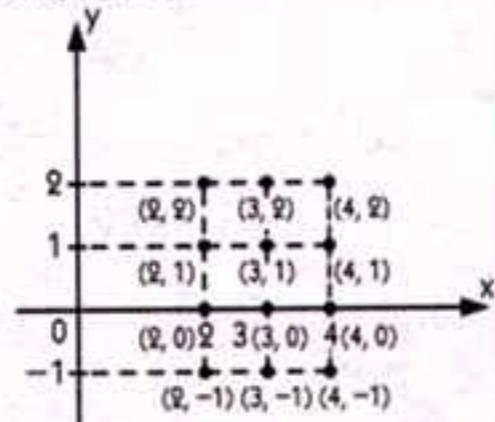
102. a) $A \times B$



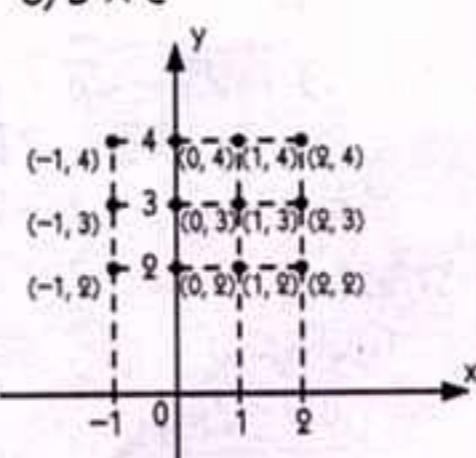
- b) $B \times A$



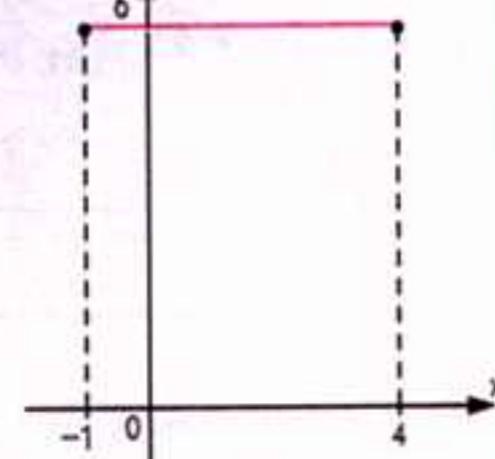
103. a) $C \times D$



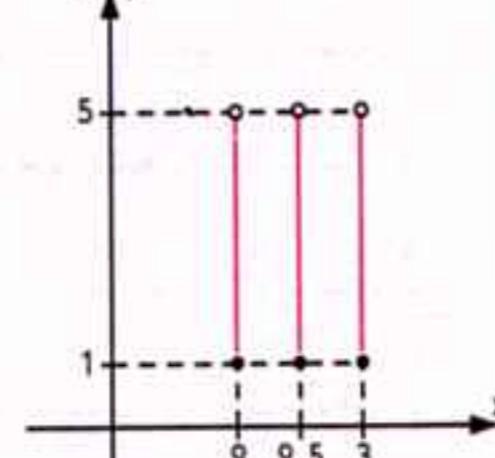
- b) $D \times C$



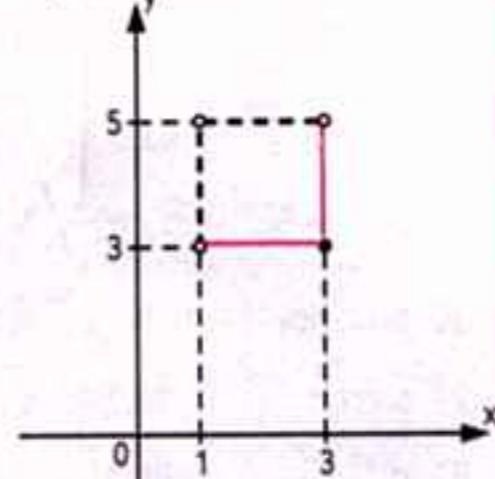
104. a)



- b)



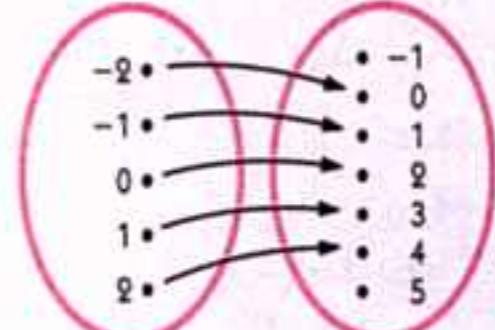
- e)



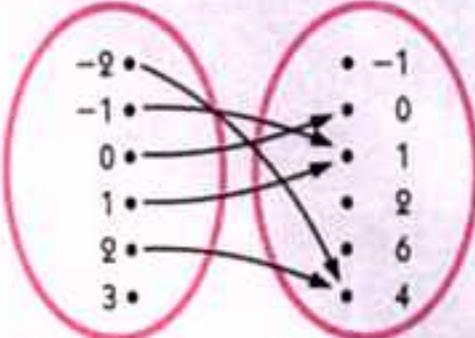
105. a) $R = \{(-2,0), (-1,1), (0,2), (1,3), (2,4)\}$

- b) $D = \{-2, -1, 0, 1, 2\}$
 $\text{Im} = \{0, 1, 2, 3, 4\}$

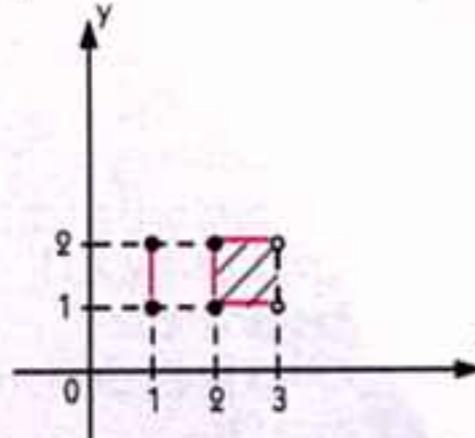
- c)



- 109.



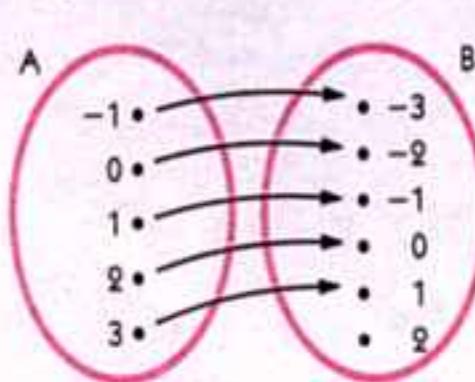
- 110.



111. Representam funções: a, c e e;
 não representam funções: b, d, f.

112. a) $R = \{(-1, -3), (0, -2), (1, -1), (2, 0), (3, 1)\}$

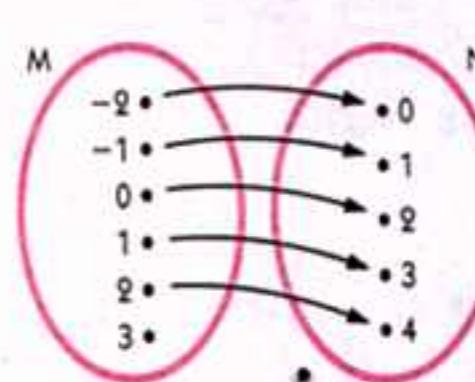
- b)



- c) É uma função, pois a cada elemento do conjunto A, corresponde um único elemento do conjunto B.

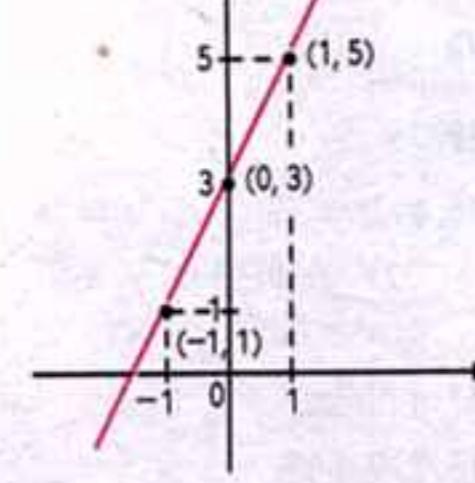
113. a) $R = \{(-2,0), (-1,1), (0,2), (1,3), (2,4)\}$

- b)



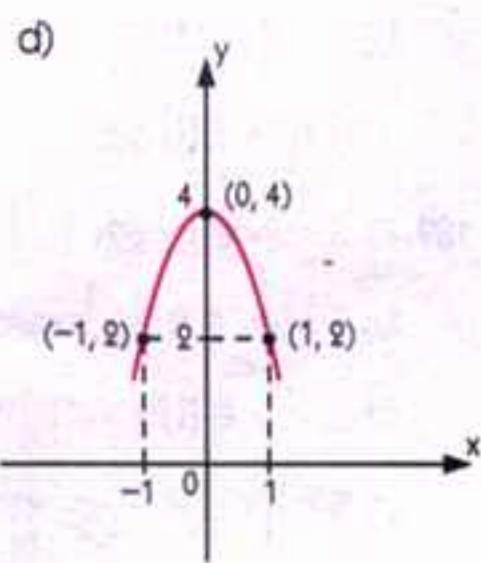
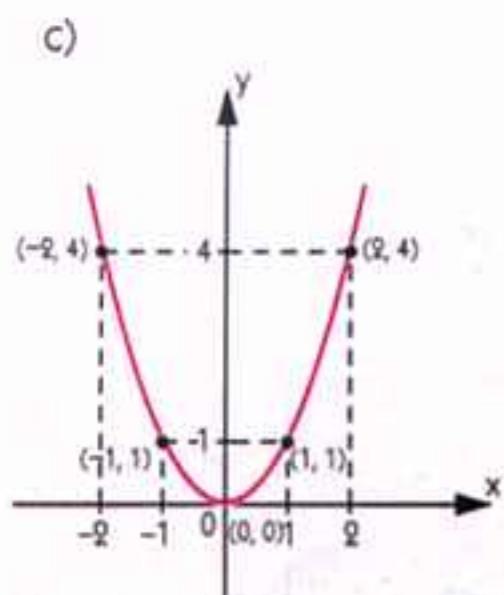
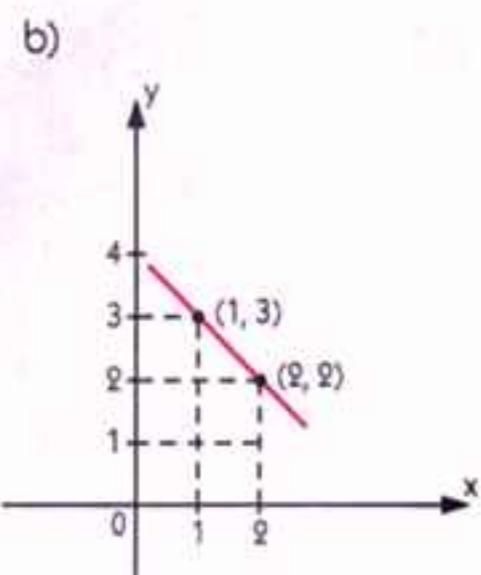
- c) Não é função, pois o elemento 3 ∈ M não possui correspondente em N.

114. a)



107. $R = \{(-3, -2), (-1, -1), (1, 0), (3, 1)\}$

108. $D = \{0, 2, 4, 6\}$
 $\text{Im} = \{1, 5, 9, 13\}$



115. a) -12 c) 0
b) -9 d) -8

116. a) 86 c) $\frac{66}{5}$
b) 51 d) 16

117. -24

118. a) 1 b) $\frac{3}{4}$

119. a) 0 d) $5e(-1)$
b) $\frac{9}{2}$ e) Não há raiz real.

c) 5 f) $-\frac{1}{2}$

120. 3 121. -2

122. $\frac{\sqrt{7} - 1}{6}$

123. a) sobrejetora
b) injetora
c) sobrejetora
d) bijetora

124. a) bijetora
b) injetora

- c) sobrejetora
d) bijetora

125. b 126. e 127. e

128. a) $D(f) = \mathbb{R}$
b) $D(f) = \{x \in \mathbb{R} | x \neq -2\}$
c) $D(f) = \{x \in \mathbb{R} | x \geq 6\}$
d) $D(f) = \{x \in \mathbb{R} | x \geq -2\}$
e) $D(f) = \{x \in \mathbb{R} | x > 3\}$

129. a) $D(f) = \mathbb{R}$
b) $D(f) = \{x \in \mathbb{R} | x < 2\}$
c) $D(f) = \left\{x \in \mathbb{R} | x \leq \frac{7}{5}\right\}$
d) $D(f) = \mathbb{R}$
e) $D(f) = \left\{x \in \mathbb{R} | x \neq -\frac{10}{7}\right\}$

130. $Im(f) = \{-1, 0, 3\}$

131. $D(f) = \left\{-1, 0, 1, 2, \frac{4}{5}\right\}$

132. $D(f) = \mathbb{R} - \{2, -2\}$

133. a) $y = x - 5$

b) $y = x + 4$

c) $y = \frac{x}{3}$

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

134. a) $y = \frac{x-2}{4}$

b) $y = \frac{2x+2}{x-1}$, para $x \neq 1$

c) $y = \frac{x+4}{1-x}$, para $x \neq 1$

135. $f^{-1}(4) = -2$

136. $f^{-1}(3) = 1$

137. $f^{-1}(2) + f^{-1}(-2) = -\frac{2}{3}$

138. e

139. a) $g[f(x)] = 8x + 1$;

$f[g(x)] = 8x + 2$

b) $g[f(x)] = -6x + 39$;

$f[g(x)] = -6x + 3$

140. $g[f(x)] = \frac{1}{x-2}$

141. $f[g(x)] = \frac{-5x-14}{x+3}$

142. $\frac{9}{2}$

143. a) $6x^2 + 1$

b) ± 1

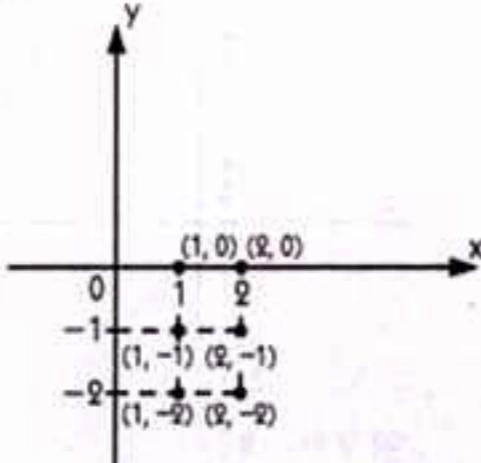
144. a 145. c 146. d

147. d 148. a 149. 3

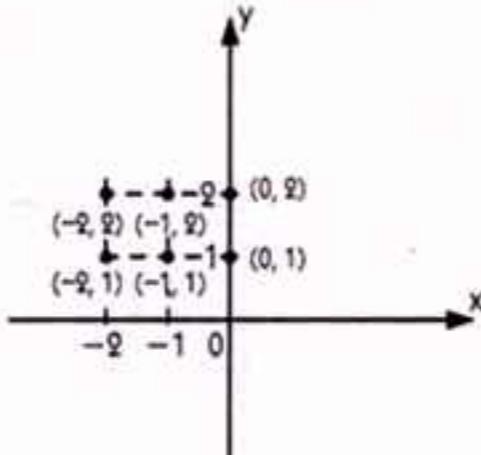
150. a 151. b

Exercícios complementares

152. a) $A \times B = \{(1, -2), (1, -1), (1, 0), (2, -2), (2, -1), (2, 0)\}$

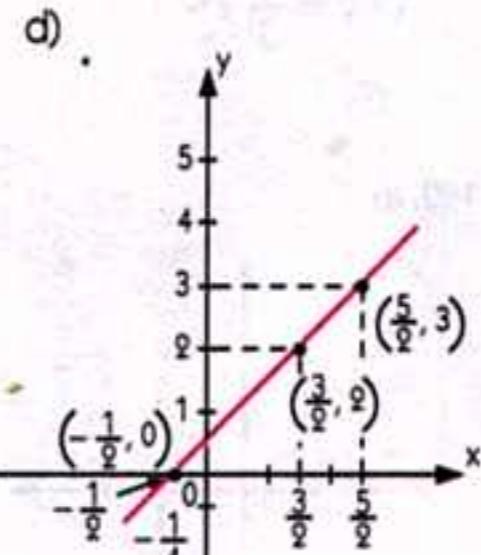
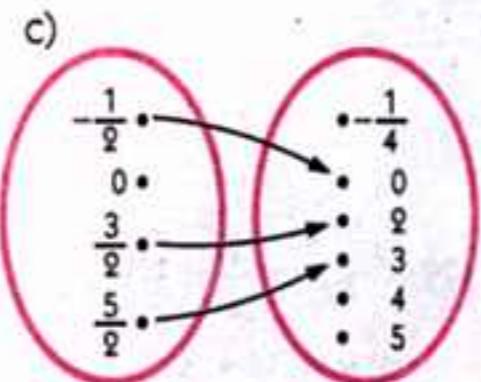


- b) $B \times A = \{(-2, 1), (-2, 2), (-1, 1), (-1, 2), (0, 1), (0, 2)\}$



153. a) $R = \left\{\left(-\frac{1}{2}, 0\right), \left(\frac{3}{2}, 2\right), \left(\frac{5}{2}, 3\right)\right\}$

- b) $D = \left\{-\frac{1}{2}, \frac{3}{2}, \frac{5}{2}\right\}; Im = \{0, 2, 3\}$



- e) Não é função, pois o elemento 0 do conjunto A não tem correspondente no conjunto B.

154. a) 18 b) 0

- c) 0 d) $\frac{13}{16}$

- e) -12

155. a) -10 c) 0,8
b) 10 d) -5 e 5

156. -1 e 3

157. a) $D(f) = \mathbb{R}$
b) $D(f) = \{x \in \mathbb{R} | x \neq 8\}$
c) $D(f) = \{x \in \mathbb{R} | x \geq 3\}$
d) $D(f) = \left\{x \in \mathbb{R} | x < -\frac{1}{4}\right\}$
e) $D(f) = \mathbb{R}$

158. a) $y = -x + 8$

b) $y = \frac{x+5}{3}$

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

d) $y = \frac{2}{x-3}$

159. 10

160. a) $g[f(x)] = -6x + 4$;
 $f[g(x)] = -6x + 5$

b) $g[f(x)] = \frac{x^2+1}{x^2-1}$;

$f[g(x)] = \left(\frac{x+1}{x-1}\right)^2$

161. $\frac{3}{2}$

162. 9x + 17

163. e 164. a 165. a

166. a 167. e 168. c

169. b 170. a

FUNÇÃO POLINOMIAL DO 1º GRAU

Exercícios propostos

171. a) $\begin{cases} a = 1 \\ b = 3 \\ \text{crescente} \\ f(2) = 5, f(-4) = -1, \\ f(0) = 3 \end{cases}$

- b) $\begin{cases} a = 4 \\ b = 2 \\ \text{crescente} \\ f(2) = 10, f(-4) = -14, \\ f(0) = 2 \end{cases}$

- c) $\begin{cases} a = -\frac{7}{2} \\ b = 0 \\ \text{decrescente} \\ f(2) = -7, f(-4) = 14, \\ f(0) = 0 \end{cases}$

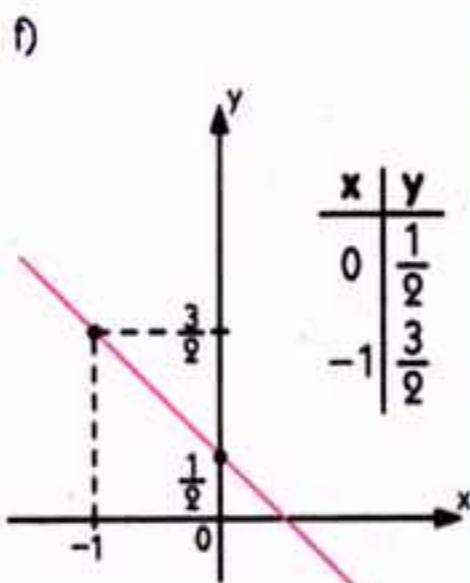
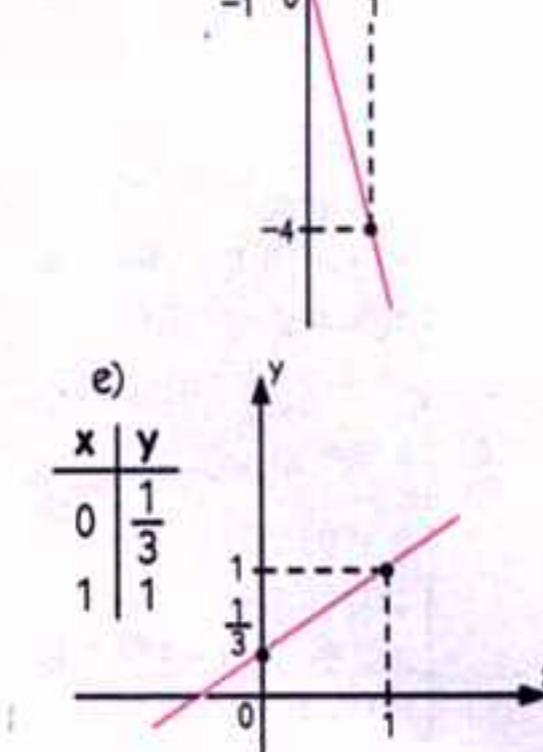
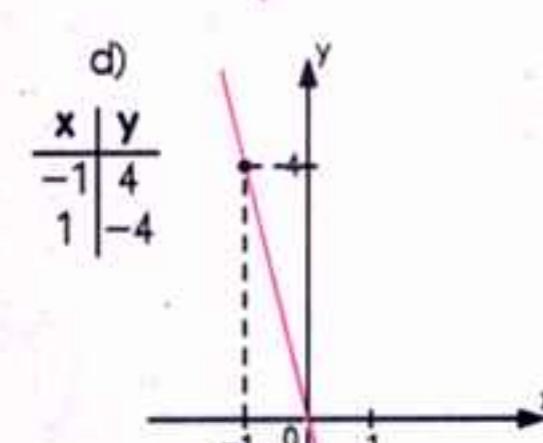
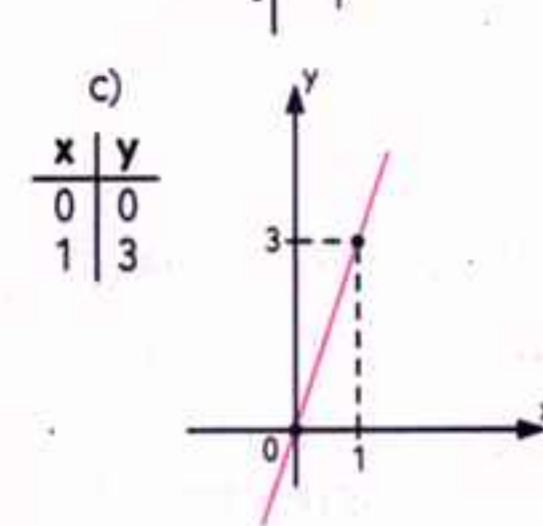
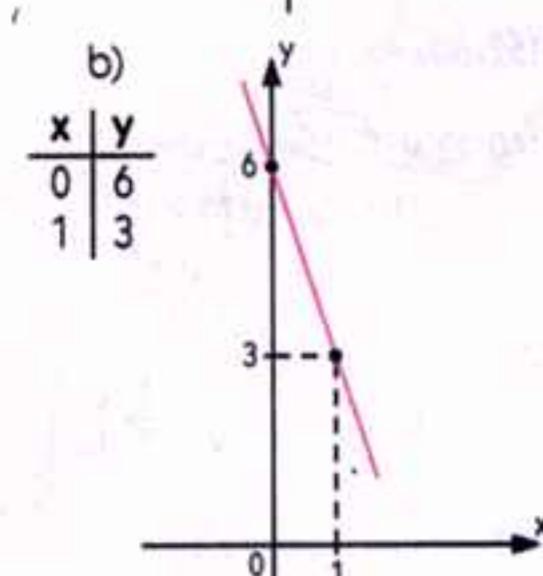
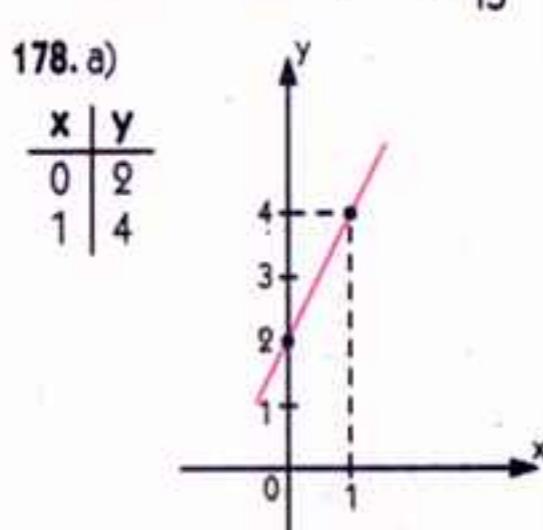
172. a) $f(x) = 3x - 4$
b) $f(x) = 2x + 5$

173. a) $f(2) = 0$
b) $f(-2) = -5$

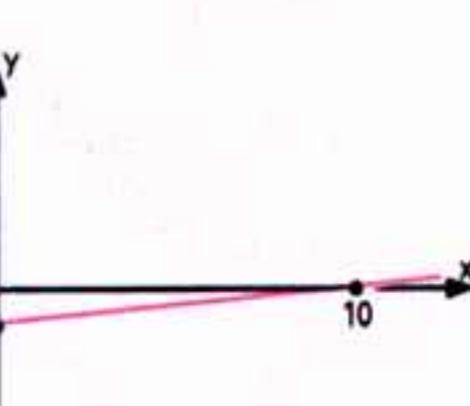
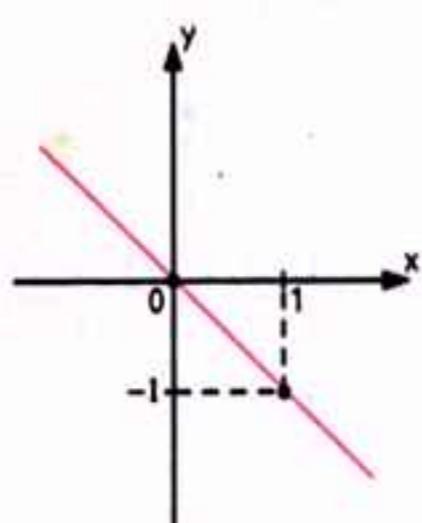
174. -1 175. 4

176. a) $y = -\frac{1}{2}x + 50, 0 \leq x \leq 100$
b) 37

177. a) -2 c) 0 e) $-\frac{5}{2}$
b) 3 d) -1 f) $\frac{8}{15}$

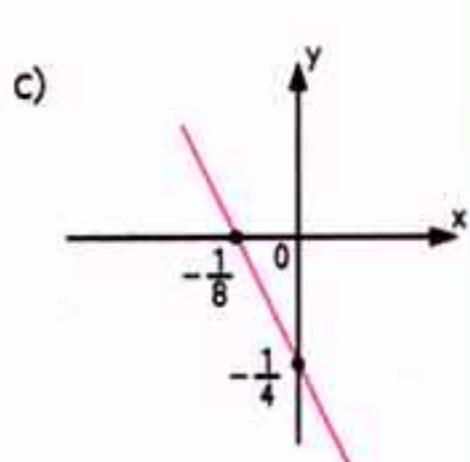
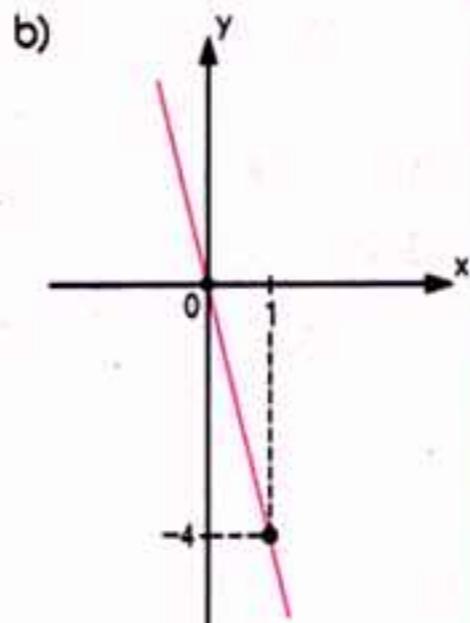
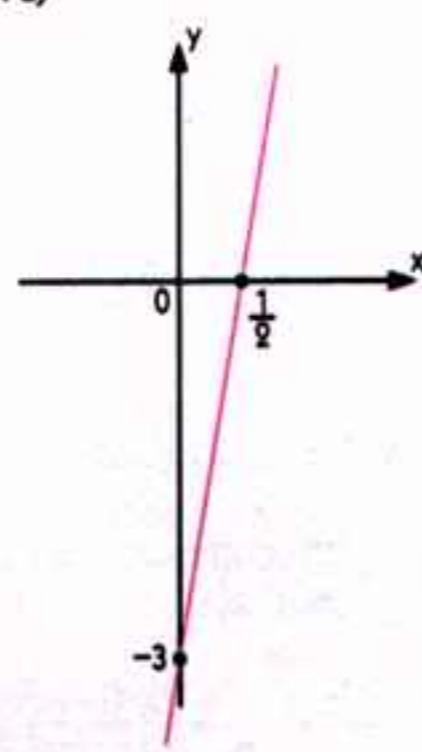


g) $y = -x$
para $\begin{cases} x = 0 \Rightarrow y = 0 \\ x = 1 \Rightarrow y = -1 \end{cases}$



179. a) $y = -\frac{2}{3}x + 2$
b) $y = 3x + 3$
c) $y = \frac{1}{3}x - 1$
d) $y = x - 1$

180. a)



181. a) $\begin{cases} y > 0 \text{ para } x > 4 \\ y = 0 \text{ para } x = 4 \\ y < 0 \text{ para } x < 4 \end{cases}$

b) $\begin{cases} y > 0 \text{ para } x < 3 \\ y = 0 \text{ para } x = 3 \\ y < 0 \text{ para } x > 3 \end{cases}$

c) $\begin{cases} y > 0 \text{ para } x > -1 \\ y = 0 \text{ para } x = -1 \\ y < 0 \text{ para } x < -1 \end{cases}$

d) $\begin{cases} y > 0 \text{ para } x < 3 \\ y = 0 \text{ para } x = 3 \\ y < 0 \text{ para } x > 3 \end{cases}$

182. a) $\begin{cases} y > 0 \text{ para } x < 1 \\ y = 0 \text{ para } x = 1 \\ y < 0 \text{ para } x > 1 \end{cases}$

b) $\begin{cases} y > 0 \text{ para } x > -\frac{3}{2} \\ y = 0 \text{ para } x = -\frac{3}{2} \\ y < 0 \text{ para } x < -\frac{3}{2} \end{cases}$

c) $\begin{cases} y > 0 \text{ para } x < -\frac{8}{3} \\ y = 0 \text{ para } x = -\frac{8}{3} \\ y < 0 \text{ para } x > -\frac{8}{3} \end{cases}$

183. a) $\begin{cases} y > 0 \text{ para } x > 0 \\ y = 0 \text{ para } x = 0 \\ y < 0 \text{ para } x < 0 \end{cases}$

b) $\begin{cases} y > 0 \text{ para } x < 0 \\ y = 0 \text{ para } x = 0 \\ y < 0 \text{ para } x > 0 \end{cases}$

184. $A = \frac{1}{8} = 0,125 \text{ (unidades)}^2$

185. a) $S = \{x \in \mathbb{R} | x > 6\}$

b) $S = \{x \in \mathbb{R} | x \geq -5\}$

c) $S = \left\{x \in \mathbb{R} | x < \frac{3}{4}\right\}$

d) $S = \{x \in \mathbb{R} | x \geq -2\}$

186. a) $S = \left\{x \in \mathbb{R} | x \leq \frac{5}{4}\right\}$

b) $S = \left\{x \in \mathbb{R} | x > \frac{3}{5}\right\}$

c) $S = \left\{x \in \mathbb{R} | x \geq \frac{3}{8}\right\}$

187. a) $S = \{x \in \mathbb{R} | x \geq -1\}$

b) $S = \{x \in \mathbb{R} | x > -2\}$

c) $S = \left\{x \in \mathbb{R} | x \leq -\frac{1}{2}\right\}$

d) $S = \{x \in \mathbb{R} | x \leq 2\}$

188. a) $S = \left\{x \in \mathbb{R} | -1 < x < \frac{1}{2}\right\}$

b) $S = \left\{x \in \mathbb{R} | \frac{5}{3} \leq x < 5\right\}$

c) $S = \{x \in \mathbb{R} | x \geq 7\}$

189. a) $S = \{x \in \mathbb{R} | x \geq 1\}$

b) $S = \left\{x \in \mathbb{R} | -\frac{1}{2} \leq x \leq 1\right\}$

c) $S = \{x \in \mathbb{R} | x > 1\}$

d) $S = \left\{x \in \mathbb{R} | \frac{1}{4} \leq x < \frac{2}{3}\right\}$

190. d

191. a) $S = \{x \in \mathbb{R} | x < -1 \text{ ou } x > 2\}$

b) $S = \left\{x \in \mathbb{R} | -1 \leq x \leq \frac{1}{2}\right\}$

c) $S = \{x \in \mathbb{R} | 1 < x < 5\}$

d) $S = \left\{x \in \mathbb{R} | x \leq \frac{1}{2} \text{ ou } x \geq 2\right\}$

192. a) $S = \left\{x \in \mathbb{R} | x < 1 \text{ ou } \frac{5}{2} < x < 3\right\}$

b) $S = \left\{x \in \mathbb{R} | -2 \leq x \leq -\frac{1}{3} \text{ ou } x \geq 3\right\}$

c) $S = \left\{x \in \mathbb{R} | x > \frac{1}{2}\right\}$

d) $S = \mathbb{R}$

193. a) $D = \left\{x \in \mathbb{R} | -\frac{5}{2} \leq x \leq \frac{1}{3}\right\}$

b) $D = \{x \in \mathbb{R} \mid x \leq 2 \text{ ou } x \geq 5\}$

194. e

195. a) $S = \{x \in \mathbb{R} \mid x < 0 \text{ ou } x > 1\}$

b) $S = \{x \in \mathbb{R} \mid -3 \leq x < -2\}$

c) $S = \left\{x \in \mathbb{R} \mid x < -2 \text{ ou } x > -\frac{1}{2}\right\}$

196. a) $V = \left\{x \in \mathbb{R} \mid -3 < x \leq -\frac{2}{3}\right\}$

b) $V = \{x \in \mathbb{R} \mid x < -5 \text{ ou } x \geq 2\}$

c) $V = \left\{x \in \mathbb{R} \mid x < -\frac{5}{2} \text{ ou } x \geq -1\right\}$

197. $D = \left\{x \in \mathbb{R} \mid -\frac{3}{2} \leq x < 4\right\}$

198. $D = \left\{x \in \mathbb{R} \mid x < \frac{1}{3} \text{ ou } \frac{2}{3} \leq x \leq 3\right\}$

199. $S = \{x \in \mathbb{R} \mid x < -1 \text{ ou } 0 \leq x < 1\}$

200. c 201. c

202. $S = \{x \in \mathbb{R} \mid x < -4 \text{ ou } x > 3\}$

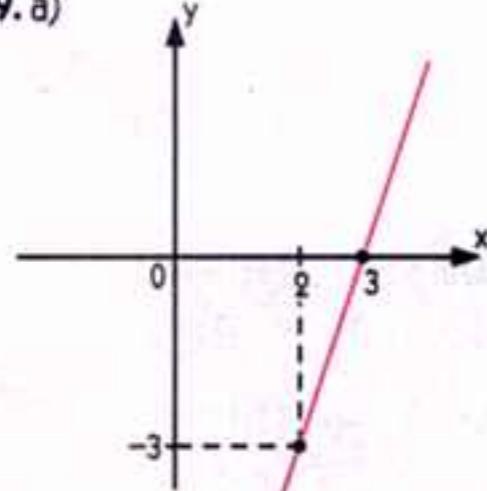
203. d 204. e 205. d

206. d 207. b

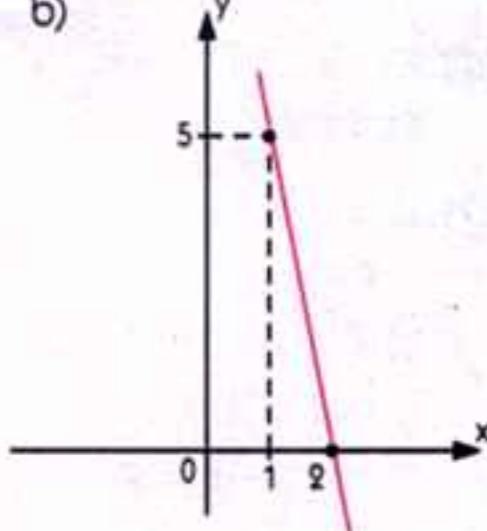
Exercícios complementares

208. a) $x = 2$ c) $x = \frac{18}{7}$
b) $x = 3$ d) $x = 0$

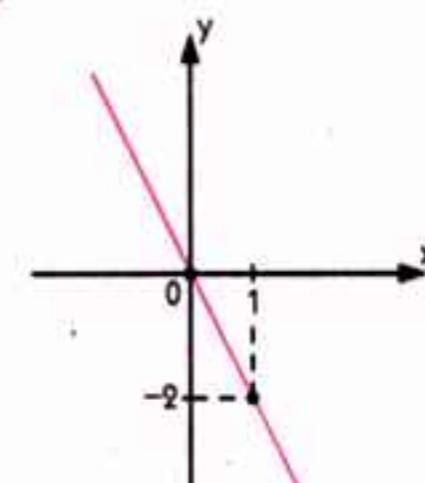
209. a)



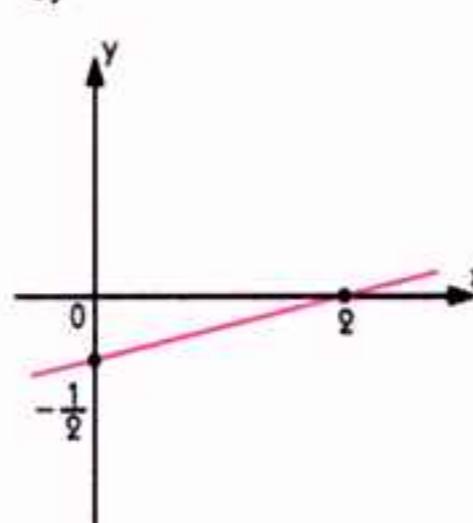
b)



c)



d)



210. $k = -2$

211. a) $a = \frac{1}{2}, b = \frac{5}{2}$

212. a) $y = -\frac{4}{3}x + 4$

b) $y = 2x - 2$

c) $y = -\frac{5}{4}x + \frac{5}{2}$

213. b 214. c 215. c

216. d 217. c 218. c

219. a) $V = \left\{x \in \mathbb{R} \mid x \leq \frac{2}{3} \text{ ou } x \geq 5\right\}$

b) $V = \{x \in \mathbb{R} \mid x \leq -2 \text{ ou } x > 3\}$

220. d 221. d 222. b

FUNÇÃO POLINOMIAL DO 2º GRAU

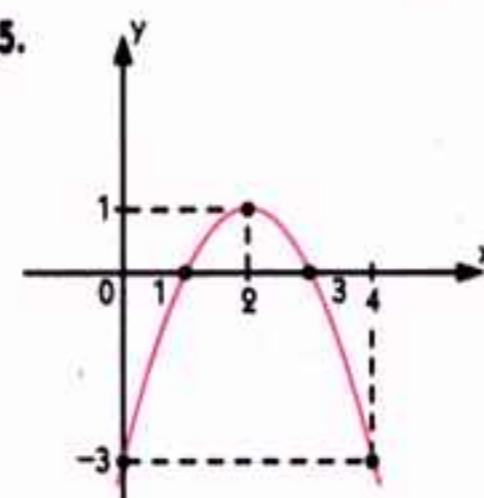
Exercícios propostos

223. a) $a = 1, b = -5, c = 6$;
concavidade para cima
b) $a = -2, b = 8, c = -8$;
concavidade para baixo
c) $a = 1, b = 0, c = -4$;
concavidade para cima
d) $a = 3, b = 1, c = 5$;
concavidade para cima
e) $a = -1, b = 1, c = -3$;
concavidade para baixo

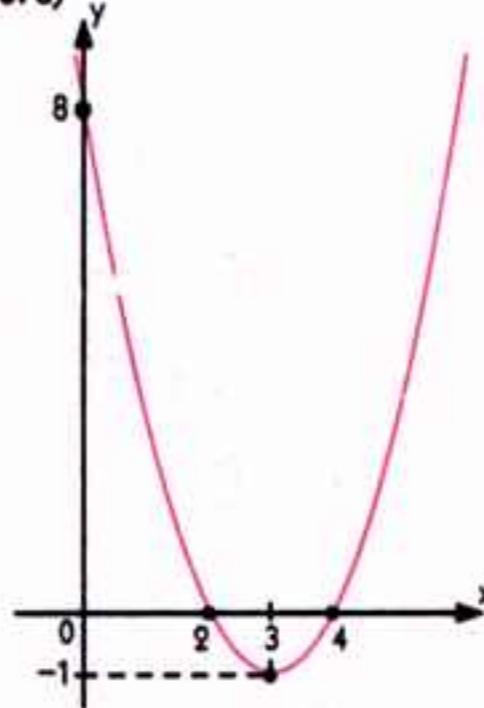
f) $a = -1, b = 1, c = 0$;
concavidade para baixo

224. a) $m \neq 1$ c) $m \neq 2$
b) $m \neq 4$ d) $m \neq \frac{7}{3}$

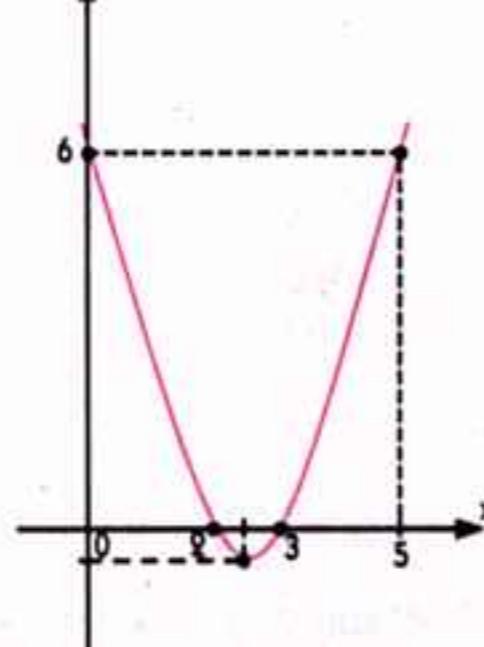
225.



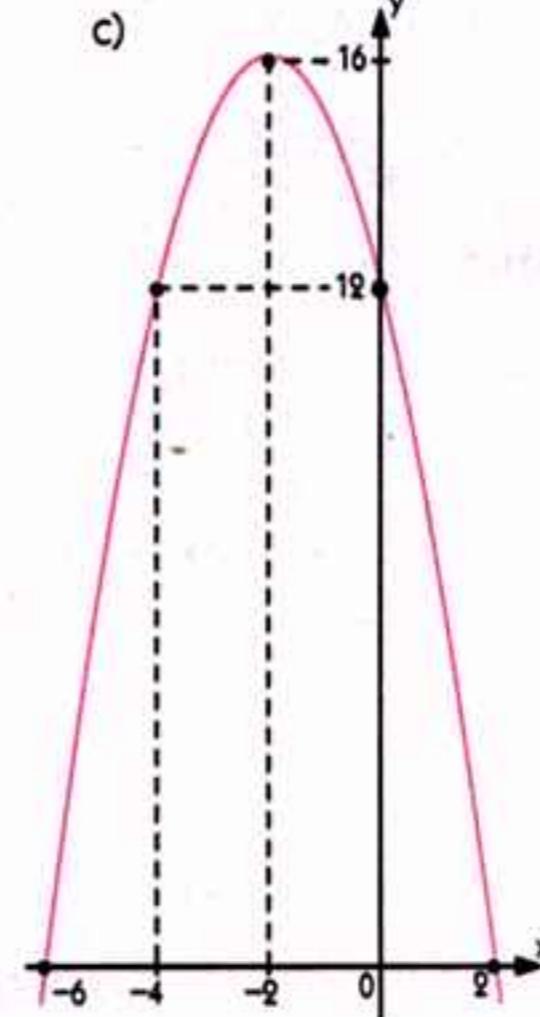
226. a)



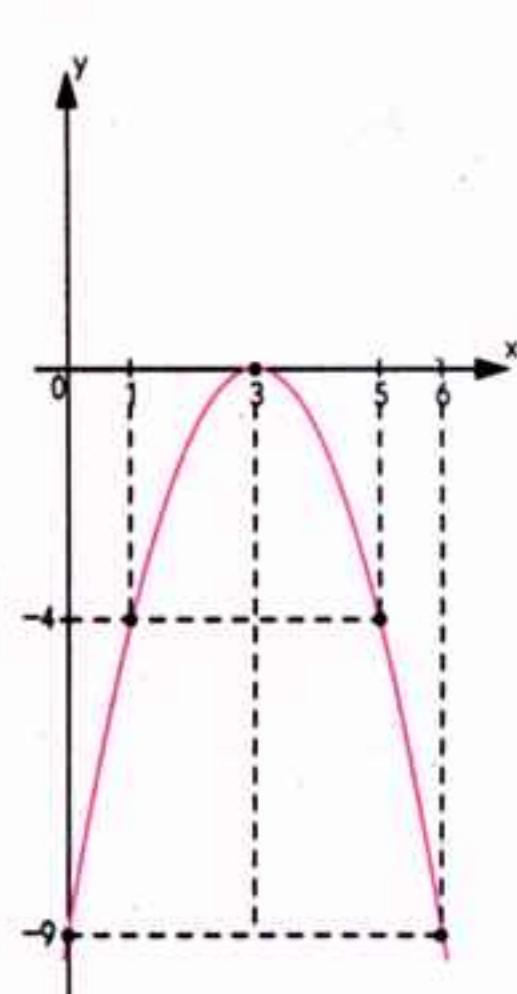
b)



c)



d)



227. a) $x' = 4 \text{ e } x'' = 1$

b) $x' = 2 \text{ e } x'' = 2$

c) $x' = 10 \text{ e } x'' = -10$

d) $x' = 2 \text{ e } x'' = 0$

228. a) $\Delta > 0$

b) $k < 3,2$

229. $k = 1$

230. $k > 1$

231. $b = \pm 4\sqrt{2}$

232. $a < \frac{1}{4} \text{ e } a \neq 0$

233. -2

234. b

235. e

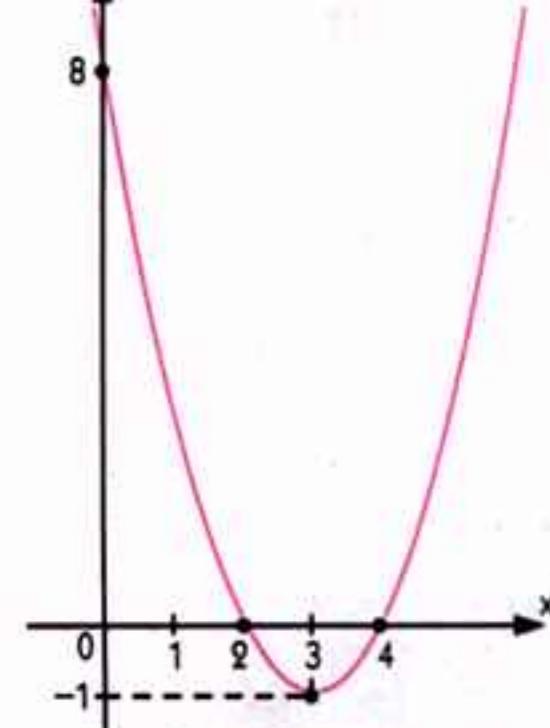
236. a) $V = (2, -1)$

b) $V = (-5, 36)$

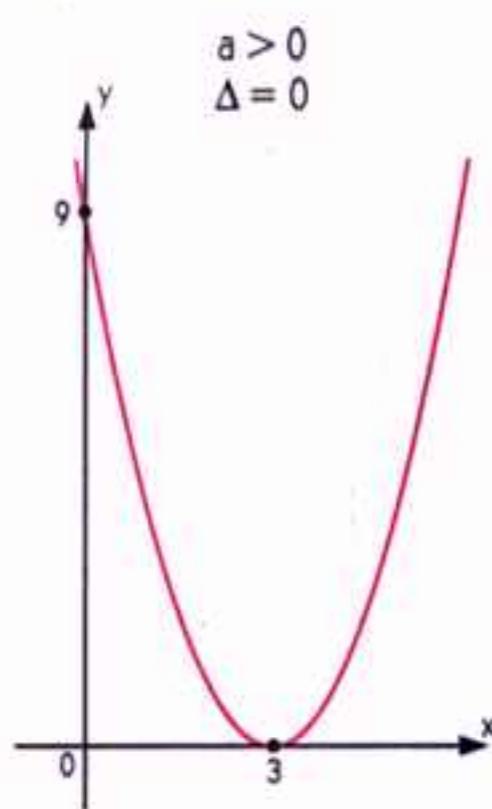
237. a)

$a > 0$
 $\Delta > 0$

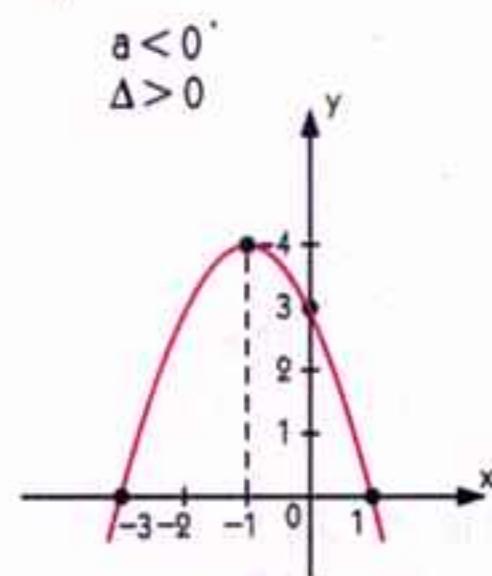
8



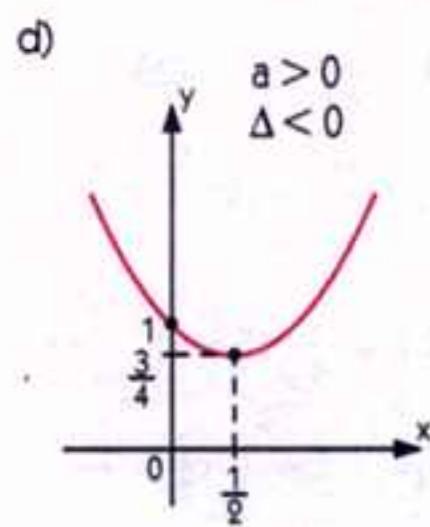
b)



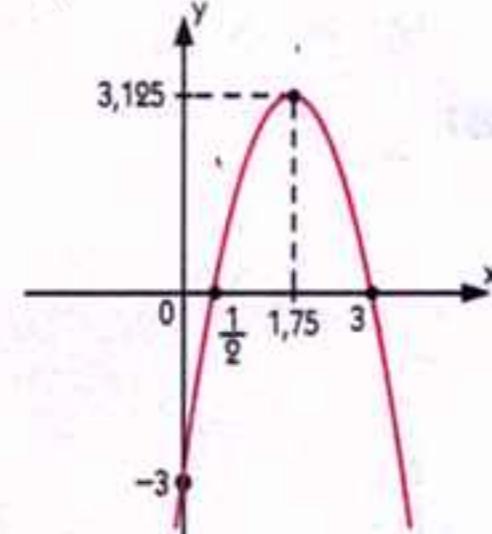
c)



d)



e)



$$238. V = \left(\frac{7}{2}, -\frac{1}{4} \right)$$

$$239. y_v = 4$$

$$241. a$$

$$243. d$$

$$244. a) Im = \{y \in \mathbb{R} | y \geq -9\}$$

$$b) Im = \left\{ y \in \mathbb{R} | y \geq -\frac{25}{4} \right\}$$

$$c) Im = \{y \in \mathbb{R} | y \geq -4\}$$

$$245. a) Im = \{y \in \mathbb{R} | y \leq 0\}$$

$$b) Im = \{y \in \mathbb{R} | y \leq 9\}$$

$$c) Im = \{y \in \mathbb{R} | y \leq 36\}$$

$$246. Im = \{y \in \mathbb{R} | y \geq -3\}$$

$$247. Im = \left\{ y \in \mathbb{R} | y \geq -\frac{9}{4} \right\}$$

$$248. a) \begin{cases} se x < -3 \text{ ou } x > -2, \\ f(x) > 0 \\ se -3 < x < -2, \\ f(x) < 0 \\ se x = -3 \text{ ou } x = -2, \\ f(x) = 0 \end{cases}$$

$$b) \begin{cases} se x < 1 \text{ ou } x > 3, \\ f(x) > 0 \\ se 1 < x < 3, f(x) < 0 \\ se x = 1 \text{ ou } x = 3, \\ f(x) = 0 \end{cases}$$

$$c) \begin{cases} se x < -\frac{1}{4} \text{ ou } \\ x > -\frac{1}{4}, f(x) > 0 \\ se x = -\frac{1}{4}, f(x) = 0 \end{cases}$$

$$d) \begin{cases} se x < 1 \text{ ou } x > 1, \\ f(x) > 0 \\ se x = 1, f(x) = 0 \end{cases}$$

$$e) \begin{cases} se x < 0 \text{ ou } x > 7, \\ f(x) > 0 \\ se 0 < x < 7, f(x) < 0 \\ se x = 0 \text{ ou } x = 7, \\ f(x) = 0 \end{cases}$$

$$249. a) se x < -3 \text{ ou } x > -3, y > 0$$

$$b) se x < -\frac{1}{4} \text{ ou } x > 1, y > 0$$

$$c) \text{ para qualquer } x \in \mathbb{R}, y > 0$$

$$d) se x < 1 \text{ ou } x > 2, y > 0$$

$$e) se x \neq 4, y > 0$$

$$250. m = \frac{17}{16}; x' = x'' = \frac{3}{4}$$

$$251. m > 35$$

$$252. a) \begin{cases} se -1 < x < 5, f(x) > 0 \\ se x < -1 \text{ ou } x > 5, \\ f(x) < 0 \\ se x = -1 \text{ ou } x = 5, \\ f(x) = 0 \end{cases}$$

$$b) \begin{cases} se -1 < x < 3, f(x) > 0 \\ se x < -1 \text{ ou } x > 3, \\ f(x) < 0 \\ se x = -1 \text{ ou } x = 3, \\ f(x) = 0 \end{cases}$$

$$c) \begin{cases} se x < 3 \text{ ou } x > 3, \\ f(x) < 0 \\ se x = 3, f(x) = 0 \end{cases}$$

$$253. a) \begin{cases} se x < 2 \text{ ou } x > 2, \\ f(x) < 0 \\ se x = 2, f(x) = 0 \end{cases}$$

$$b) \text{ para qualquer valor de } x, \\ f(x) < 0$$

$$c) \text{ para qualquer valor de } x, \\ f(x) < 0$$

$$254. \{k \in \mathbb{R} | k < -25\}$$

$$255. \left\{ m \in \mathbb{R} | m < -\frac{1}{8} \right\}$$

$$256. \{m \in \mathbb{R} | m < -2 \text{ ou } m > -1\}$$

$$257. a) \begin{cases} x < \frac{1}{3} \text{ ou } x > 8, \\ f(x) < 0 \\ \frac{1}{3} < x < 8, f(x) > 0 \\ x = \frac{1}{3} \text{ ou } x = 8, \\ f(x) = 0 \end{cases}$$

$$b) \begin{cases} x < \frac{1}{3} \text{ ou } x > 8, \\ f(x) > 0 \\ \frac{1}{3} < x < 8, f(x) < 0 \\ x = \frac{1}{3} \text{ ou } x = 8, \\ f(x) = 0 \end{cases}$$

$$258. a) a < 0; \Delta > 0$$

$$b) a > 0; \Delta = 0$$

$$c) a < 0; \Delta < 0$$

$$d) a > 0; \Delta > 0$$

$$259. a) a > 0; b < 0; c > 0$$

$$b) a < 0; b > 0; c < 0$$

$$c) a < 0; b < 0; c < 0$$

$$d) a < 0; b < 0; c > 0$$

$$260. a) V = \{x \in \mathbb{R} | x < 2 \text{ ou } x > 3\}$$

$$b) V = \{x \in \mathbb{R} | -4 \leq x \leq 3\}$$

$$c) V = \{x \in \mathbb{R} | 2 < x < 4\}$$

$$d) V = \{x \in \mathbb{R} | x \neq 3\}$$

$$e) V = \{x \in \mathbb{R} | x > 5 \text{ ou } x < 3\}$$

$$f) V = \mathbb{R}$$

$$261. a) V = \mathbb{R}$$

$$b) V = \left\{ x \in \mathbb{R} | x \leq \frac{1}{2} \text{ ou } x \geq 1 \right\}$$

$$c) V = \{x \in \mathbb{R} | x < -2 \text{ ou } x > 3\}$$

$$d) V = \{x \in \mathbb{R} | -4 \leq x \leq 4\}$$

$$e) V = \{x \in \mathbb{R} | x < 0 \text{ ou } x > 7\}$$

$$262. V = \{x \in \mathbb{R} | x < -3 \text{ ou } x > 5\}$$

$$263. D = \{x \in \mathbb{R} | x \leq -3 \text{ ou } x \geq 3\}$$

$$264. -2\sqrt{6} \leq k \leq 2\sqrt{6}$$

$$265. a) S = \{x \in \mathbb{R} | 0 < x < 1\}$$

$$b) S = \{x \in \mathbb{R} | x \leq -6\}$$

$$c) S = \{\}$$

$$266. a) S = \{x \in \mathbb{R} | 1 < x < 3 \text{ ou } 4 < x < 8\}$$

$$b) S = \left\{ x \in \mathbb{R} | x < -3 \text{ ou } x > -\frac{1}{2} \right\}$$

$$267. b$$

$$268. a) S = \left\{ x \in \mathbb{R} | x \leq -\frac{1}{2} \text{ ou } 2 \leq x \leq 4 \right\}$$

$$b) S = \{x \in \mathbb{R} | -5 \leq x \leq 1 \text{ ou } x \geq 3\}$$

$$c) S = \{x \in \mathbb{R} | x \leq 2 \text{ ou } x \geq 3\}$$

$$269. a) S = \{x \in \mathbb{R} | x < -1 \text{ ou } x > 4\}$$

$$b) S = \left\{ x \in \mathbb{R} | \frac{1-\sqrt{5}}{2} < x < \frac{1+\sqrt{5}}{2} \right\}$$

$$c) S = \{x \in \mathbb{R} | 0 \leq x \leq 2 \text{ ou } 3 \leq x \leq 5\}$$

$$270. S = \{x \in \mathbb{R} | 1 < x < 2 \text{ ou } 3 < x < 4\}$$

$$271. S = \{x \in \mathbb{R} | 0 < x < 2 \text{ ou } 5 < x < 6\}$$

$$272. S = \mathbb{R} - \{4\}$$

$$273. S = \{x \in \mathbb{R} | 5 \leq x \leq 7 \text{ ou } x = 2\}$$

$$274. a) S = \{x \in \mathbb{R} | x < 4 \text{ e } x \neq 1\}$$

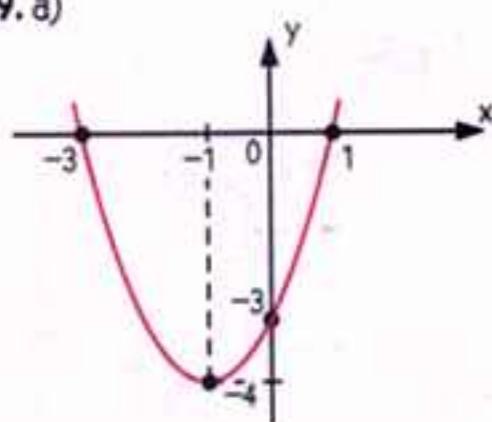
$$b) S = \{x \in \mathbb{R} | -1 < x < 3 \text{ ou } x > 5\}$$

$$c) S = \{x \in \mathbb{R} | x < -1 \text{ ou } 1 \leq x < 3 \text{ ou } x \geq 6\}$$

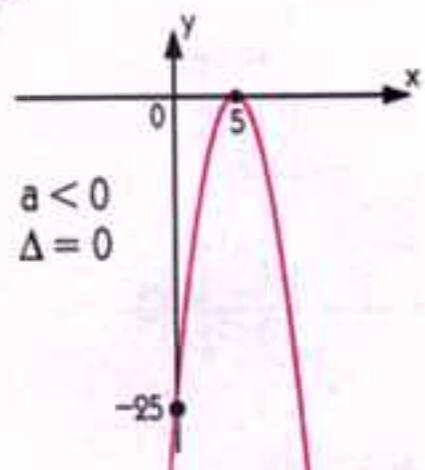
275. a) $V = \{x \in \mathbb{R} \mid -3 \leq x < 1\}$
 ou $2 \leq x < 3\}$
 b) $V = \{x \in \mathbb{R} \mid x < 3\}$
 ou $x > 4$ e $x \neq 5\}$
 c) $V = \{x \in \mathbb{R} \mid -6 < x < -3$ ou
 $-2 < x < 1$ ou $x > 2\}$
 276. $S = \{x \in \mathbb{R} \mid x < 0\}$
 277. $S = \{x \in \mathbb{R} \mid x < -2$ ou
 $-1 < x < 0$ ou $x > 1\}$
 278. d 279. e 280. d
 281. e 282. a 283. d
 284. $S = \{x \in \mathbb{R} \mid x < -3$ ou
 $-2 < x < -1\}$
 285. c

Exercícios complementares

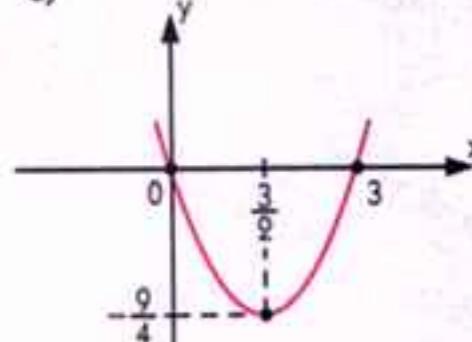
286. a) $k \neq \pm 1$
 b) $k \neq 0$ e $k \neq 1$
 287. a = 0 e b = -8
 288. a = 1, b = -4 e c = 3
 289. a)



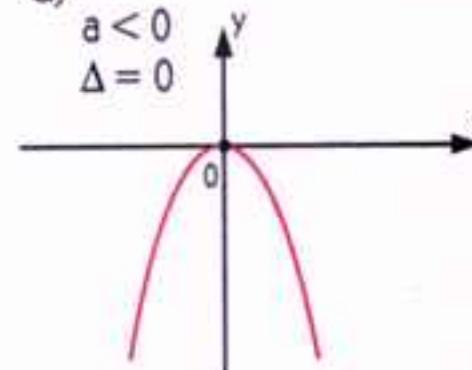
b)



c)

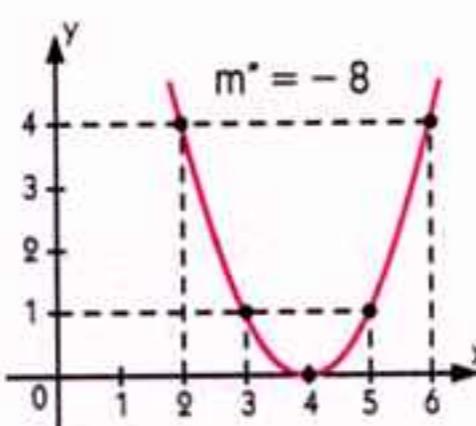
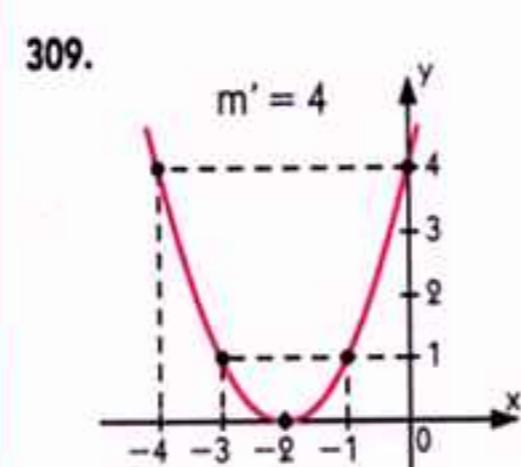


d)



290. a) $D(f) = \mathbb{R}$
 $\text{Im}(f) = \left\{y \in \mathbb{R} \mid y \geq -\frac{1}{4}\right\}$
 b) $D(f) = \mathbb{R}$
 $\text{Im}(f) = \{y \in \mathbb{R} \mid y \leq 0\}$

291. 20 292. b 293. c 294. b
 295. d 296. b 297. e 298. a
 299. b 300. d 301. a 302. b
 303. c 304. a 305. d 306. c



310. e

FUNÇÃO EXPONENCIAL

Exercícios propostos

311. a) 1 c) 1 e) $\sqrt{5}$
 b) 1 d) 3π f) -7,2

312. a) 0 c) -32 e) 9
 b) 32 d) 0 f) 8

313. a) 81 c) 1 e) -1
 b) 1 d) -81 f) -1

314. a) $\frac{1}{9}$ c) $\frac{1}{16}$ e) $\frac{1}{\pi^3}$
 b) $\frac{1}{125}$ d) $\frac{1}{16}$ f) $\frac{1}{16}$

315. a) $\frac{9}{3}$ c) $\frac{10}{3}$ e) $-\frac{1}{\pi^3}$
 b) $\frac{5}{2}$ d) 2 f) $\frac{3}{2}$

316. a) 3^5
 b) $5^{-2} = \frac{1}{5^2}$
 c) $2^{-5} = \frac{1}{2^5}$
 d) $2^2 \cdot 7^2$
 e) $\left(\frac{1}{4}\right)^2 \cdot \left(\frac{1}{3}\right)^2$

f) 11^6

317. a) 5^4
 b) $3^{-6} = \frac{1}{3^6}$
 c) $0,2^8$
 f) 7^4

318. a) $(0,2)^{-2} = 25$

- b) $\frac{1}{3^5} = \frac{1}{243}$
 c) $\frac{5^3}{4^3} = \frac{125}{64}$
 d) $5^{-1} = \frac{1}{5}$
 e) $10^{-3} = \frac{1}{10^3} = \frac{1}{1000}$
 f) $\frac{1}{4\pi} \approx 0,08$

319. a) 9 c) 16 e) $\frac{1}{4}$
 b) 9 d) $\frac{1}{5}$ f) 2

320. a) $\frac{1}{9}$ c) 5 e) $\frac{1}{9}$
 b) 27 d) 2 f) 10

321. a) 4 c) 25 e) 72
 b) 4 d) $\frac{1}{\pi}$ f) 9

322. a) 15 c) $\frac{1}{128}$ e) $\frac{5}{3}$
 b) 4 d) $\frac{6}{7}$ f) $\frac{3}{5}$

323. a) $V = \{6\}$ d) $V = \{2\}$
 b) $V = \{3\}$ e) $V = \left\{-\frac{1}{2}\right\}$

- c) $V = \left\{\frac{5}{3}\right\}$ f) $V = \{-5\}$

324. a) $V = \{3\}$ d) $V = \left\{\frac{1}{4}\right\}$
 b) $V = \left\{\frac{1}{4}\right\}$ e) $V = \{0\}$

- c) $V = \left\{\frac{1}{2}\right\}$ f) $V = \left\{-\frac{5}{2}\right\}$

325. a) $V = \{-2\}$ b) $V = \left\{\frac{1}{3}\right\}$
 c) $V = \left\{-\frac{44}{15}\right\}$

- d) $V = \{-2, 0\}$

326. a) $V = \{0\}$ c) $V = \{2\}$
 b) $V = \{1\}$ d) $V = \{2\}$

327. a) $V = \{1\}$ c) $V = \{3\}$
 b) $V = \{3\}$ d) $V = \{1\}$

328. $-\frac{1}{2}$

329. a) $V = \{0, 1\}$ c) $V = \{1, 2\}$
 b) $V = \{0, 1\}$ d) $V = \{1, 3\}$

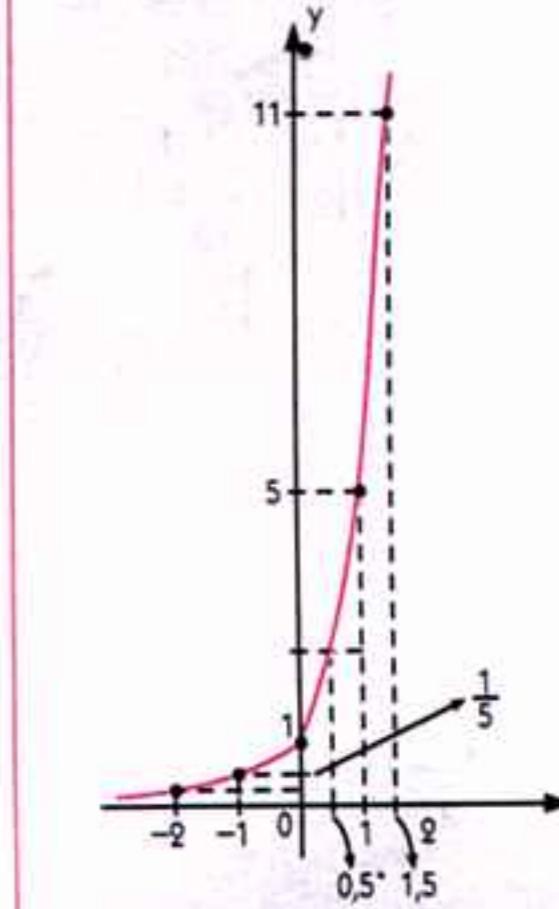
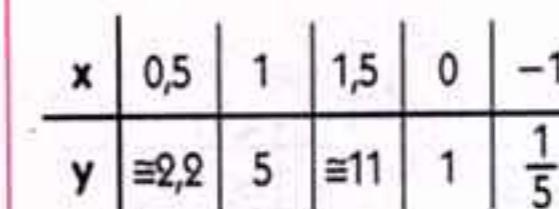
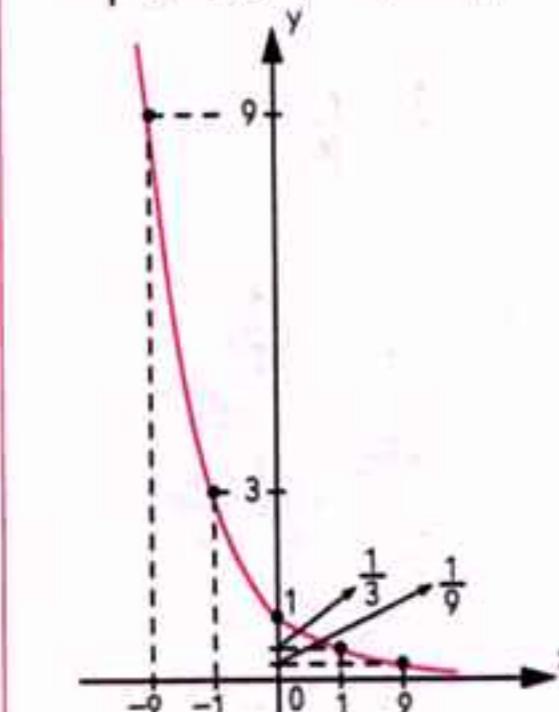
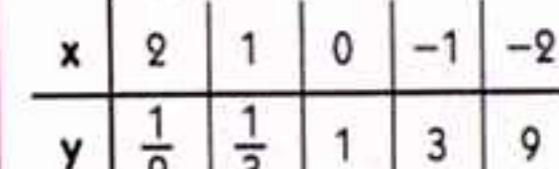
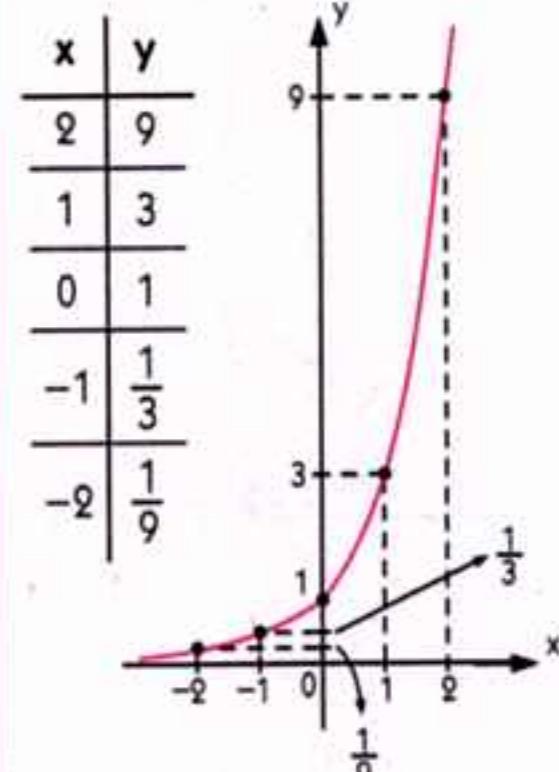
330. $V = \{1, 2\}$

331. a) $V = \{0, 4\}$ b) $V = \{2\}$

332. a) $V = \{2, 3\}$ b) $V = \{-1\}$

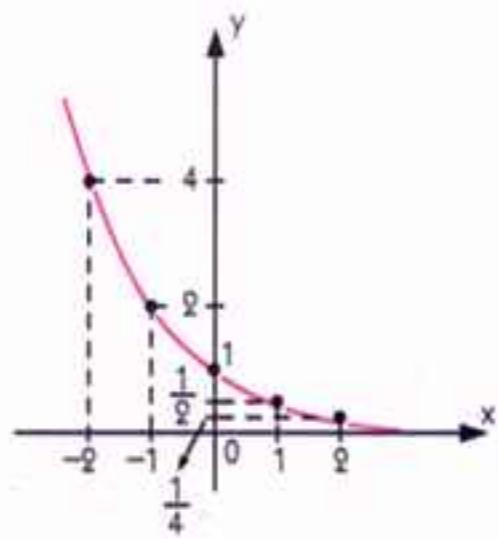
333. $V = \{0, 2\}$ 334. b

335. a) função crescente; $a > 1$



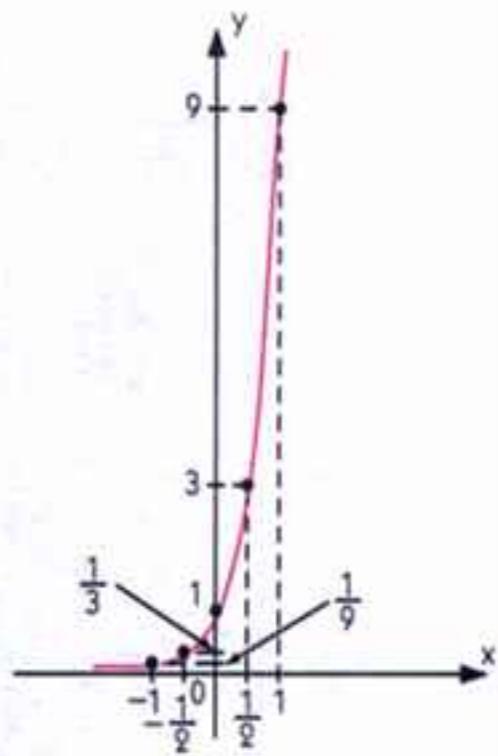
d) função decrescente;
 $0 < a < 1$

x	2	1	0	-1	-2
y	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4



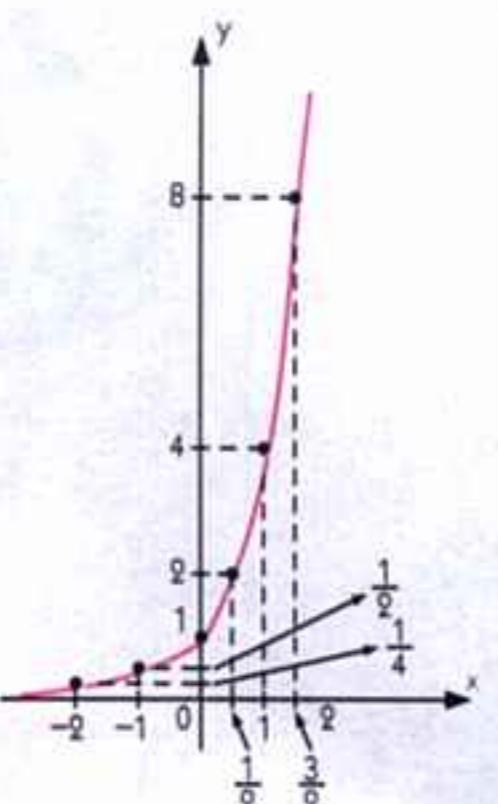
336. a) $f(x) = 3^{2x}$ ou $y = 3^{2x}$

x	1	$\frac{1}{2}$	0	$-\frac{1}{2}$	-1
y	9	3	1	$\frac{1}{3}$	$\frac{1}{9}$



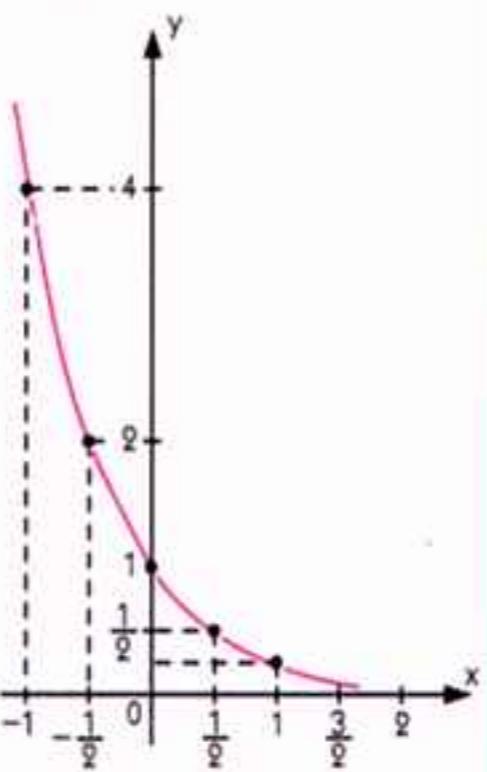
b) função crescente; $a > 1$

x	$\frac{1}{2}$	1	$\frac{3}{2}$	0	-1	$-\frac{1}{2}$
y	2	4	8	1	$\frac{1}{4}$	$\frac{1}{2}$



c) função decrescente;
 $0 < a < 1$

x	$\frac{1}{2}$	1	$\frac{3}{2}$	0	-1	$-\frac{1}{2}$
y	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	1	4	2

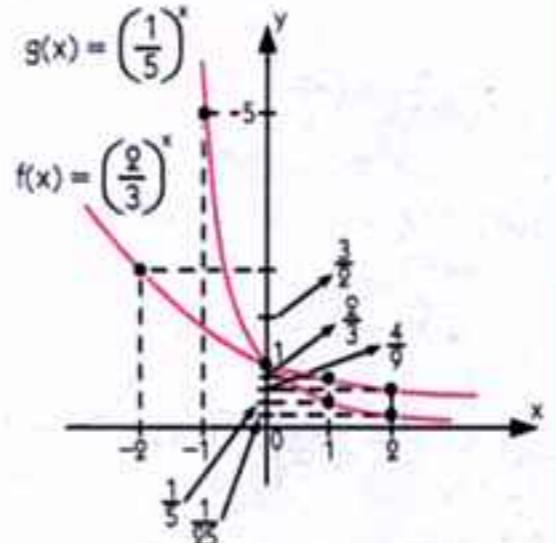


337. c

338. a

339.

x	$f(x) = \left(\frac{2}{3}\right)^x$	$g(x) = \left(\frac{1}{5}\right)^x$
2	$\frac{4}{9}$	$\frac{1}{25}$
1	$\frac{2}{3}$	$\frac{1}{5}$
0	1	1
-1	$\frac{3}{2}$	5



340. a) $V = \{x \in \mathbb{R} | x > 3\}$

b) $V = \{x \in \mathbb{R} | x < 4\}$

c) $V = \{x \in \mathbb{R} | x < 2\}$

d) $V = \{x \in \mathbb{R} | x \geq 2\}$

341. a) $V = \left\{x \in \mathbb{R} | x \geq \frac{1}{2}\right\}$

b) $V = \left\{x \in \mathbb{R} | x \leq \frac{1}{2}\right\}$

c) $V = \{x \in \mathbb{R} | x > -1\}$

d) $V = \left\{x \in \mathbb{R} | \frac{1}{2} \leq x \leq 1\right\}$

342. a) $V = \{x \in \mathbb{R} | x < -2\}$

b) $V = \{x \in \mathbb{R} | x > 1\}$

c) $V = \{x \in \mathbb{R} | x < -2 \text{ ou } x > 3\}$

d) $V = \{x \in \mathbb{R} | x \leq 0\}$

Exercícios complementares

343. a) $V = \{2\}$

b) $V = \left\{\frac{1}{4}\right\}$

c) $V = \left\{-\frac{3}{4}\right\}$

d) $V = \left\{-\frac{1}{4}\right\}$

e) $V = \left\{-\frac{3}{4}\right\}$

f) $V = \{-3\}$

g) $V = \{0, 3\}$

h) $V = \{0, 4\}$

i) $V = \{1, 5\}$

j) $V = \{\pm \sqrt{3}\}$

344. a) $V = \{9\}$ d) $V = \{1\}$

b) $V = \{-13\}$ e) $V = \{0, 1\}$

c) $V = \{0\}$ f) $V = \{0\}$

345. a) $V = \{0, 2\}$

b) $V = \left\{\frac{1}{5}\right\}$

c) $V = \{0, 3\}$

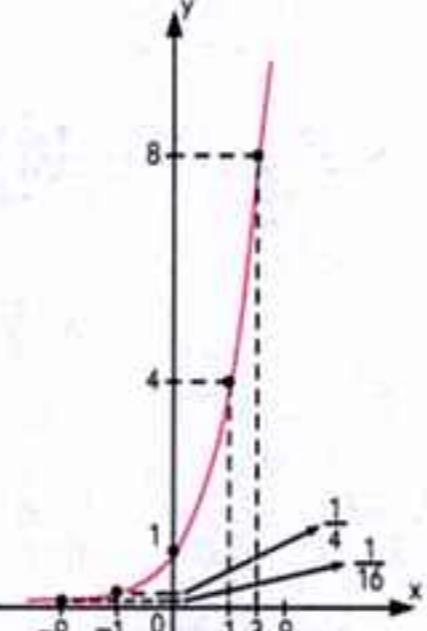
d) $V = \{2\}$

e) $V = \{0, 2\}$

f) $V = \{1\}$

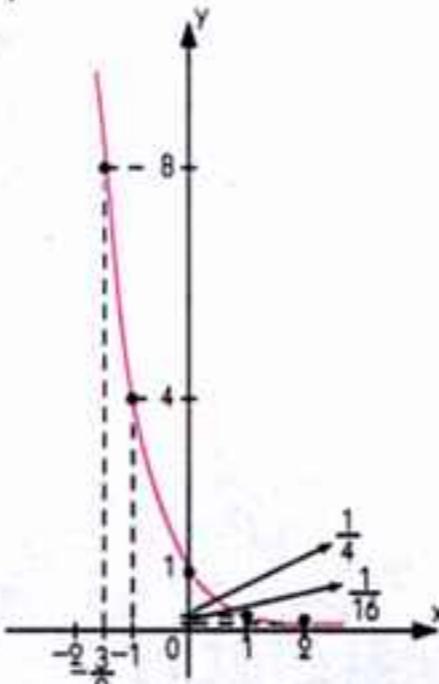
346. a) função crescente; $a > 1$

x	$\frac{3}{2}$	1	0	-1	-2
y	8	4	1	$\frac{1}{4}$	$\frac{1}{16}$



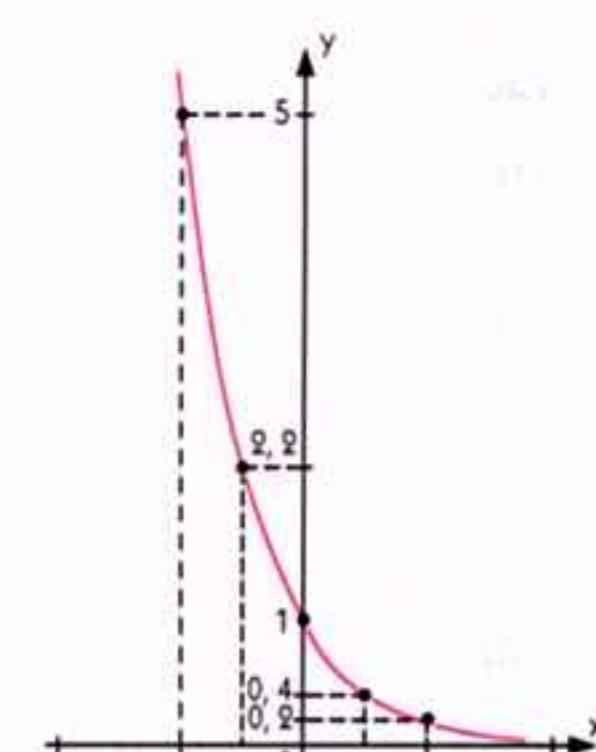
b) função decrescente;
 $0 < a < 1$

x	2	1	0	-1	$-\frac{3}{2}$
y	$\frac{1}{16}$	$\frac{1}{4}$	1	4	8



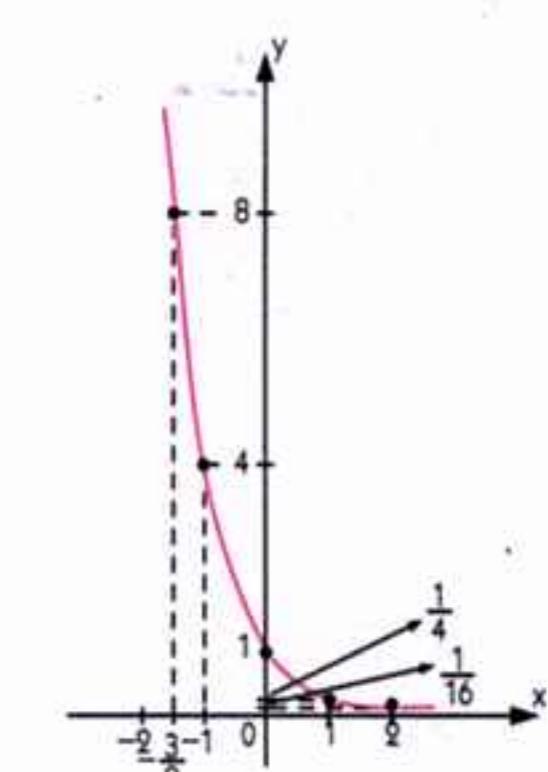
c) função decrescente;
 $0 < a < 1$

x	$\frac{1}{2}$	1	0	-1	$-\frac{1}{2}$
y	$\approx 0,4$	$\frac{1}{5}$	1	5	$\approx 2,2$



d) função decrescente;
 $0 < a < 1$

x	2	1	0	-1	$-\frac{3}{2}$
y	$\frac{1}{16}$	$\frac{1}{4}$	1	4	8



347. a) $V = \{x \in \mathbb{R} | x < 0\}$

b) $V = \{x \in \mathbb{R} | x \leq 3\}$

c) $V = \left\{x \in \mathbb{R} | x > \frac{5}{3}\right\}$

d) $V = \{x \in \mathbb{R} | x < -3$
ou $x > 3\}$

e) $V = \{x \in \mathbb{R} | x < -5$
ou $x > -1\}$

f) $V = \{x \in \mathbb{R} | x \leq 3\}$

g) $V = \left\{x \in \mathbb{R} | x > \frac{1}{2}\right\}$

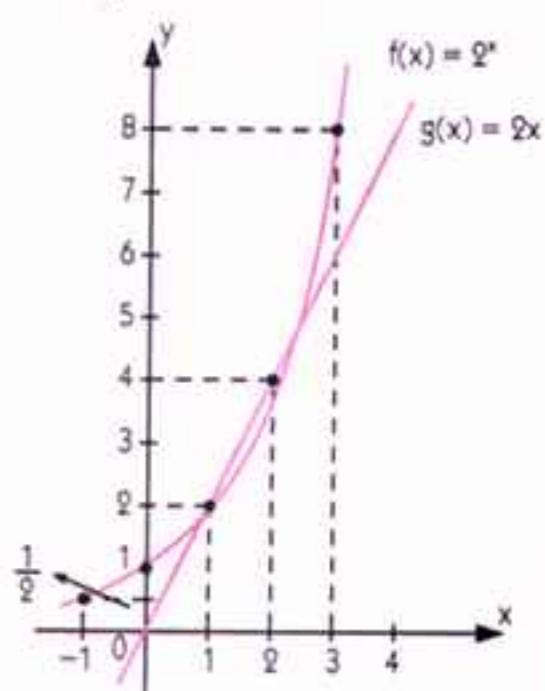
h) $V = \left\{x \in \mathbb{R} | x \geq \frac{16}{19}\right\}$

i) $V = \{x \in \mathbb{R} | -4 \leq x \leq -2\}$

j) $V = \{x \in \mathbb{R} | 1 < x < 3\}$

348. c 349. d 350. e 351. b

352. a)



- b) $S = \{x \in \mathbb{R} \mid 1 \leq x \leq 2\}$
c) $2\sqrt{2}$ é maior que $2^{\sqrt{2}}$

353. c 354. b 355. b

356. c 357. 19 800 bactérias

358. 300 bactérias

359. a) aproximadamente 553 peças
b) 300 peças; sim

360. a) $f(6) = 125$

$$\begin{aligned} b) f(a+b) &= e^{k \cdot (a+b)} = \\ &= e^{ka+kb} = e^{ka} \cdot e^{kb} = \\ &= f(a) \cdot f(b) \end{aligned}$$

361. d

362. $S = \{x \in \mathbb{R} \mid x \leq 1\}$

363. b 364. e 365. c

FUNÇÃO LOGARÍTMICA

Exercícios propostos

366. a) $\frac{3}{2}$ c) 2

b) $-\frac{1}{3}$ d) $\frac{1}{2}$

367. a

368. a) $x = -\frac{3}{4}$ f) $x = \frac{1}{4}$

b) $x = \frac{1}{3}$ g) $x = -\frac{1}{6}$

c) $x = -\frac{1}{3}$ h) $x = \frac{9}{2}$

d) $x = 3$ i) $x = -\frac{3}{4}$

e) $x = -2$ j) $x = -\frac{8}{7}$

369. a) 5 f) 4 j) 2

b) 4 g) 3 l) $\frac{5}{2}$

c) $\frac{3}{2}$ h) -4 m) 0

d) $\frac{1}{4}$ i) $-\frac{3}{2}$ n) 1

e) -3

370. d

$$372. \frac{4096}{625}$$

371. 2

$$373. \frac{1}{2}$$

374. a) $x > -7$

b) $5 \neq x < 6$

c) $x > 4$

d) $-2 < x < 2, x \neq 0 \text{ e } x \neq \pm 1$

$$375. \frac{\sqrt{2}}{2}$$

376. 3

$$377. a) S = \frac{3}{2}$$

$$b) S = -\frac{14}{6}$$

$$c) S = \frac{41}{6}$$

$$378. a) 0,9030$$

$$g) -4$$

$$b) 1,0791$$

$$h) 2,3010$$

$$c) 1,8572$$

$$i) 3,4771$$

$$d) 0,1505$$

$$j) 0,5927$$

$$e) 1,0167$$

$$l) 0,0198$$

$$f) 0,6990$$

$$m) -0,13385$$

$$379. 3a + b$$

$$380. 10^{-3} e 0,3$$

$$381. a) 3 \log a + \log b$$

$$b) \log \pi + 2 \log r$$

$$c) 2 \log_2 \ell - \frac{3}{2}$$

$$d) 2 \log a + \frac{2}{3} \log b - \frac{1}{2} \log c$$

$$382. \frac{9}{32}$$

$$383. d$$

$$384. d$$

$$385. c$$

$$386. 3m + 2n$$

$$387. a$$

$$388. a) 0,7736$$

$$d) -1,8572$$

$$b) 0,3890$$

$$e) -0,6777$$

$$c) 0,3597$$

$$f) 1,1761$$

$$389. -0,630$$

$$390. e$$

$$391. e$$

$$392. -\frac{1}{3}$$

$$393. a) V = \{2\} \quad c) V = \{4\}$$

$$b) V = \{125\} \quad d) V = \{243\}$$

$$394. a) S = \{5\}$$

$$c) S = \{1, 4\}$$

$$b) S = \{3\}$$

$$d) S = \{0, 2\}$$

$$395. a) V = \left\{ \frac{3}{2}, -4 \right\}$$

$$b) V = \left\{ -\frac{1}{3}, -2 \right\}$$

$$c) V = \{-7, 3\}$$

$$d) V = \{8\}$$

$$e) V = \{3\}$$

$$396. a) S = \left\{ \frac{-1 + 3\sqrt{5}}{2} \right\}$$

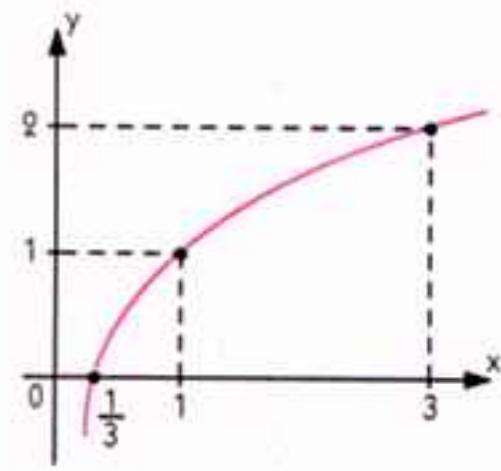
$$b) S = \{4\}$$

$$c) S = \{1\}$$

397. $x = 99$

398. $S = \{5\}$

414. a)



399. a) $V = \{6\}$ c) $V = \{3\}$

b) $V = \{6\}$

400. d 401. $x = \frac{1}{6}$

402. $x = -8$ ou $x = 4$

403. a) $V = \emptyset$

b) $V = \{5\}$

c) $V = \{3 + \sqrt{11}\}$

d) $V = \{2, 3\}$

404. a) $V = \{9\}$ c) $V = \{16\}$

b) $V = \{625\}$ d) $V = \{7\}$

405. sim, o número 2

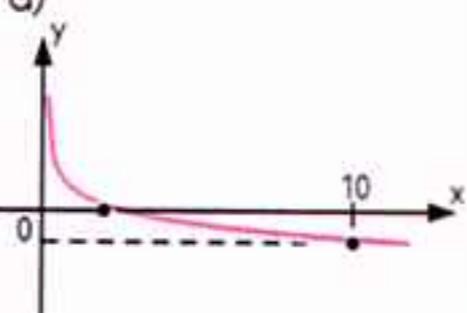
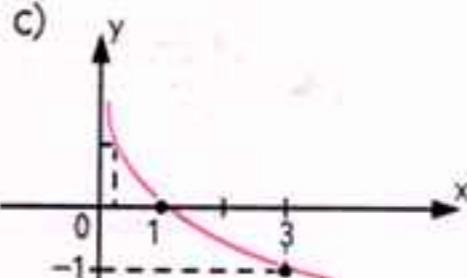
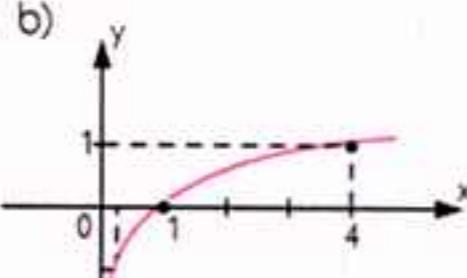
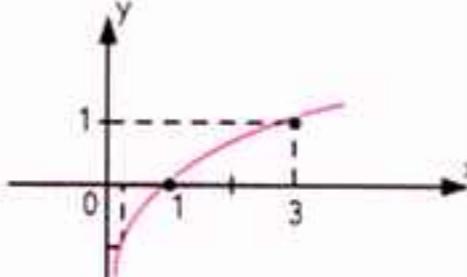
406. d 407. $V = \{10, 100\}$

408. $V = \{2\}$ 409. d

$$410. V = \left\{ \frac{1}{16}, 16 \right\}$$

$$411. V = \left\{ \left(32, \frac{1}{4} \right) \right\}$$

412. a)



415. a) $D = \mathbb{R}_+^*$, $\text{Im} = \mathbb{R}$

b) $D = \mathbb{R}_+^*$, $\text{Im} = \mathbb{R}$

c) $D = \{x \in \mathbb{R} \mid x > 1\}$, $\text{Im} = \mathbb{R}$

d) $D = \{x \in \mathbb{R} \mid x < 1\}$, $\text{Im} = \mathbb{R}$

e) $D(f) = \left\{ x \in \mathbb{R} \mid x > \frac{1}{2} \right\}$
 $\text{Im}(f) = \mathbb{R}$

f) $D(f) = \{x \in \mathbb{R} \mid x > 8\}$
 $\text{Im}(f) = \mathbb{R}$

417. a) $D(f) = \{x \in \mathbb{R} \mid x > 2 \text{ e } x \neq 3\}$

b) $D(f) = \{x \in \mathbb{R} \mid x > 9 \text{ e } x \neq 10\}$

c) $D(f) = \{x \in \mathbb{R} \mid x > 3\}$

d) $D(f) = \{x \in \mathbb{R} \mid 1 < x < 3 \text{ e } x \neq 2\}$

e) $D(f) = \{x \in \mathbb{R} \mid x \neq 3\}$

418. a) verdadeira

b) falsa

c) falsa

419. a) $x > 6$ b) $x \leq 8$

- c) $x < 3$ d) $x > 2$
 e) $x \geq 7$ f) $x > 4$
 g) $x < -\frac{2}{3}$ h) $-\frac{1}{5} < x < 1$
420. a) $V = \{x \in \mathbb{R} \mid -1 < x < 8\}$
 b) $V = \left\{x \in \mathbb{R} \mid 2 < x < \frac{9}{4}\right\}$
 c) $V = \{x \in \mathbb{R} \mid -3 < x < -1\}$
 ou $0 < x < 2\}$
 d) $V = \left\{x \in \mathbb{R} \mid x > \frac{1}{2}\right\}$
 e) $V = \{x \in \mathbb{R} \mid -7 < x < -5$
 ou $1 < x < 3\}$
 f) $V = \left\{x \in \mathbb{R} \mid 1 < x < \frac{3}{2}\right\}$
 g) $V = \{x \in \mathbb{R} \mid 0 < x < 3\}$
 h) $V = \left\{x \in \mathbb{R} \mid 1 < x \leq \frac{5 + \sqrt{109}}{6}\right\}$
 i) $V = \left\{x \in \mathbb{R} \mid x > \frac{1}{2}\right\}$
 j) $V = \{x \in \mathbb{R} \mid 1 < x \leq 2\}$

421. $V = \{x \in \mathbb{R} \mid 2 < x < 3\}$

422. a) 423. d) 424. b)

425. a) $V = \{x \in \mathbb{R} \mid 1 < x < 2\}$
 b) $V = \left\{x \in \mathbb{R} \mid \frac{1}{8} \leq x < 1\right\}$

426. d)

Exercícios complementares

427. a) -2 d) $\frac{9}{5}$ g) -1
 b) -1 e) 0 h) $\frac{5}{12}$
 c) $\frac{1}{4}$ f) 1

428. 3 429. $x = 3$

430. b) 431. a)

432. a) $x > -4$
 b) $x < -\frac{1}{3}$
 c) $x < 3$ e $x \neq \frac{8}{3}$
 d) $x < 2$ ou $x > 5$

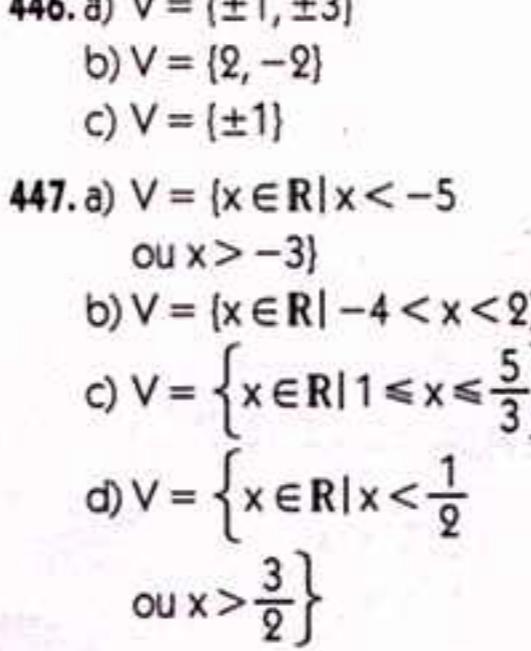
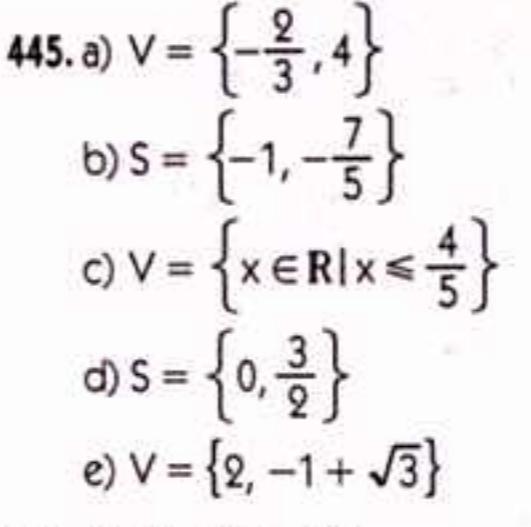
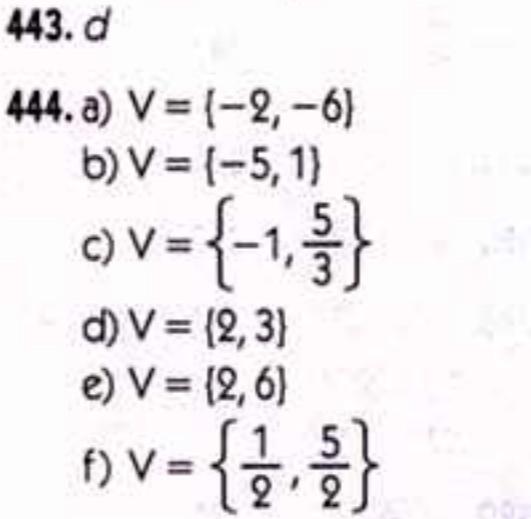
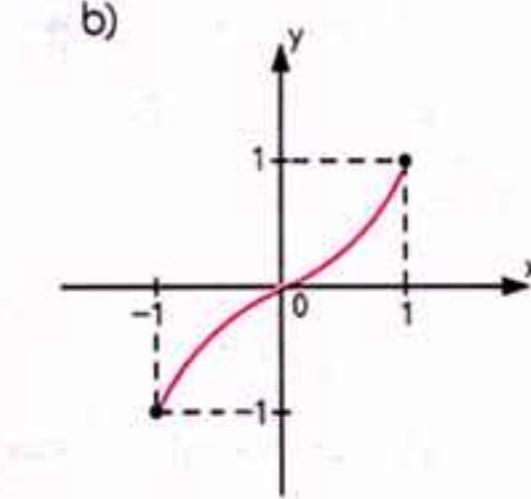
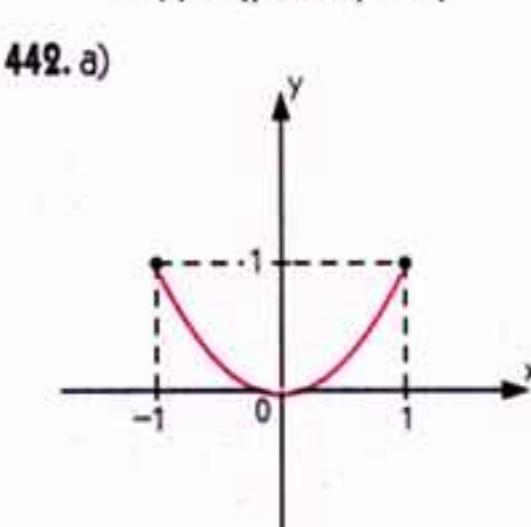
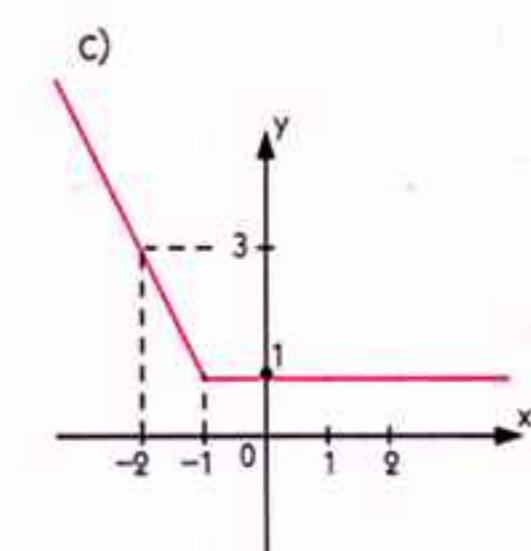
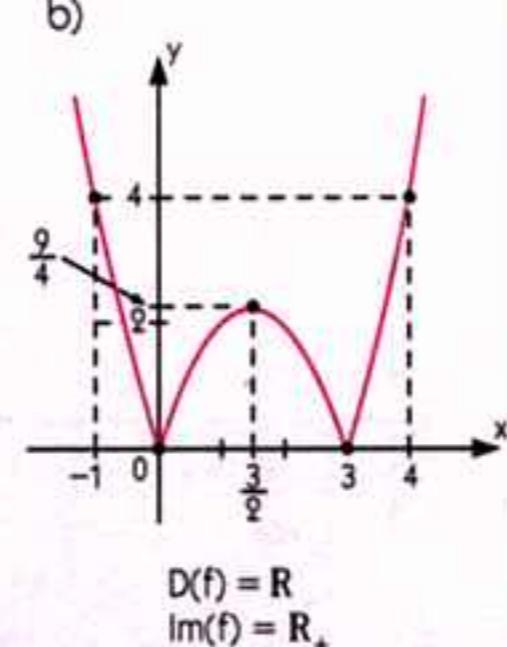
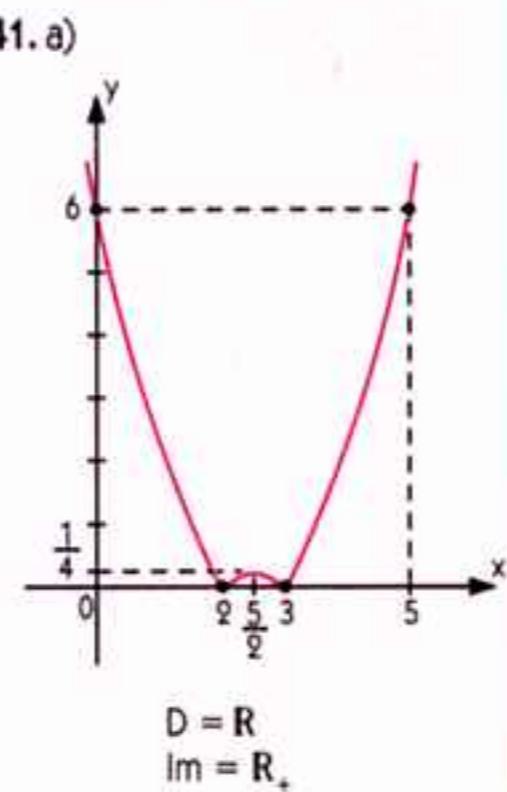
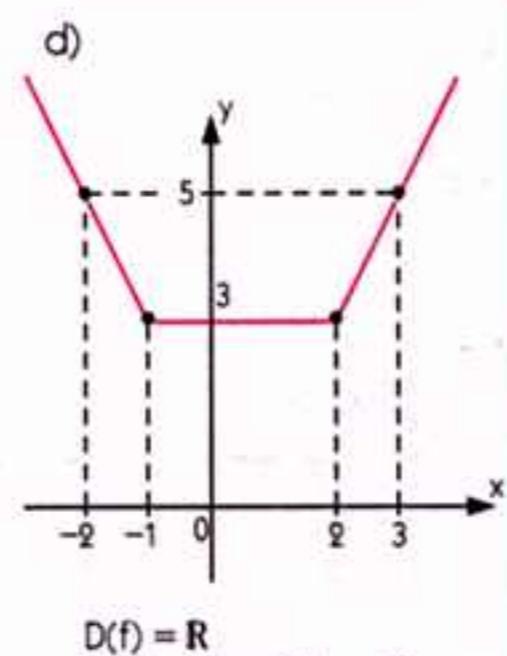
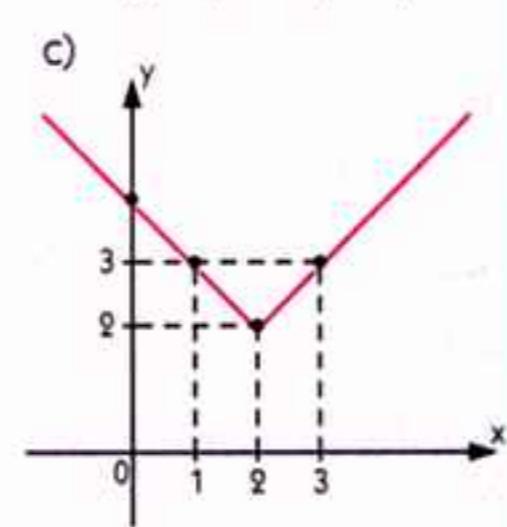
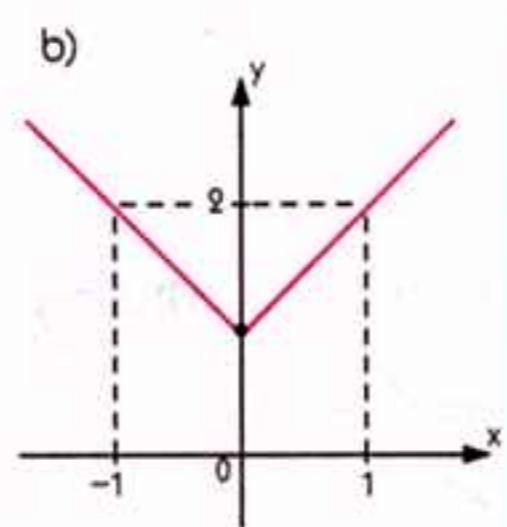
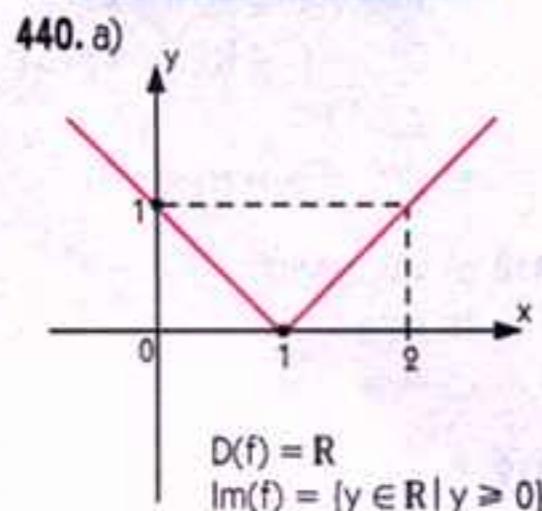
433. c)

434. a) 1,204 c) 2,096
 b) 0,5395 d) 0,5774

435. b) 436. d) 437. d)

438. c) 439. $x = \sqrt{10}$

FUNÇÃO MODULAR



448. a) $V = \{x \in \mathbb{R} \mid x < -1$
 ou $x > 2\}$
 b) $V = \{x \in \mathbb{R} \mid x \neq 2, x \neq 1\}$
 c) $V = \{x \in \mathbb{R} \mid -3 < x <$
 $< -\sqrt{3}$ ou $\sqrt{3} < x < 3\}$

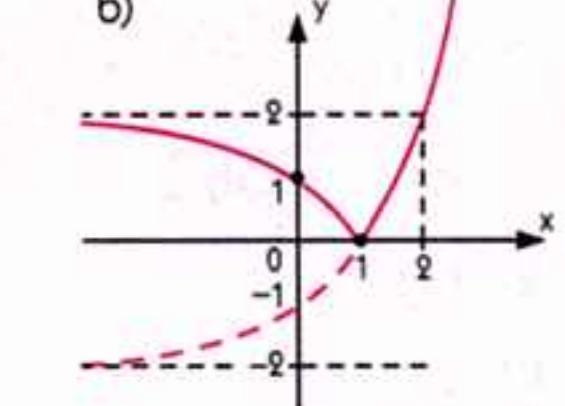
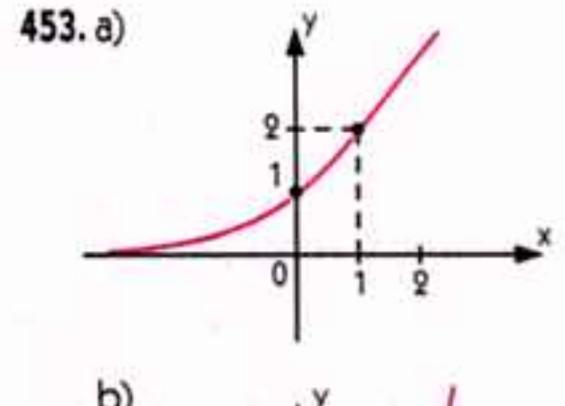
449. a) $V = \left\{x \in \mathbb{R} \mid \frac{1}{3} < x < 3,$
 $x \neq 1\right\}$
 b) $V = \left\{x \in \mathbb{R} \mid \frac{1}{3} < x < 5\right\}$
 c) $V = \left\{x \in \mathbb{R} \mid x \geq \frac{1}{2}\right\}$
 d) $V = \left\{x \in \mathbb{R} \mid x < -\frac{11}{3}$
 ou $x > -\frac{13}{5}, x \neq -1\right\}$

Exercícios complementares

450.

451. $\text{Im}(f) = \left[0, \frac{1}{4}\right]$

452. a)



454. $V = \{x \in \mathbb{R} \mid -1 < x < 0$
 ou $x > 1\}$

455. b)

456. $V = [1; 2]$

457. $V = [-2; 1]$

458. $V = \{x \in \mathbb{R} \mid x \leq -1$
 ou $x \geq 1\}$

459. $V = \{x \in \mathbb{R} \mid x \geq 1 \text{ e } x \neq 2\}$

460. d)

461. b)

TRIGONOMETRIA

Exercícios propostos

462. a) $\frac{4}{5}$ e) 1 i) $\frac{3}{4}$

b) $\frac{3}{5}$ f) $\frac{3}{5}$ j) 1

c) $\frac{4}{3}$ g) $\frac{4}{5}$

d) $\frac{4}{3}$ h) $\frac{3}{4}$

463. a) $2\sqrt{2}$ c) $\frac{\sqrt{2}}{2}$

b) $\frac{\sqrt{2}}{2}$ d) 1

464. a) $\frac{1}{2}$ c) $\frac{\sqrt{3}}{3}$ e) $\frac{1}{2}$

b) $\frac{\sqrt{3}}{2}$ d) $\frac{\sqrt{3}}{2}$ f) $\sqrt{3}$

465. a) $\frac{3}{5}$ b) $\frac{4}{5}$

466. $\frac{5}{13}, \frac{12}{13}, \frac{12}{5}$

467. d 468. $4\sqrt{3}$ m

469. altura = 5,12 m

470. $\frac{3}{1}$ 471. a

472. a 473. c

474. $H = \frac{h(\operatorname{tg} \alpha + \operatorname{tg} \beta)}{\operatorname{tg} \alpha}$

475. AB = 75 m 476. c

477. a) $\frac{\pi}{4}$ rad d) $\frac{3\pi}{4}$ rad

b) $\frac{2\pi}{5}$ rad e) $\frac{4\pi}{3}$ rad

c) $\frac{\pi}{5}$ rad f) $\frac{10\pi}{3}$ rad

478. a) 30° d) 225°

b) 120° e) 540°

c) 18° f) 432°

479. $120^\circ, \frac{2\pi}{3}$ rad

480. a) $92^\circ 30'$ c) 135°

b) 145° d) $\alpha = 7^\circ 30'$

481. $\gamma = 2$ rad

482. AB = 18 cm 483. 3 rad

484. r ≥ 1 cm 485. 30 cm

486. $\theta = 2,1$ rad

$\ell = 19,6$ cm

487. a) 1° c) 3° e) 1°

b) 2° d) 3° f) 3°

488. a) 1° c) 3°

b) 1° d) 4°

489. a) são côngruos

b) são côngruos

490. vértice A: 0

vértice B: $\frac{\pi}{3}$ rad

vértice C: $\frac{2\pi}{3}$ rad

vértice D: π rad

vértice E: $\frac{4\pi}{3}$ rad

vértice F: $\frac{5\pi}{3}$ rad

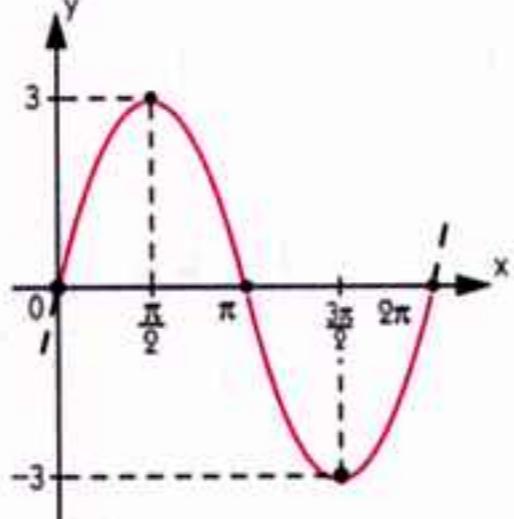
expressão geral dos arcos:

$x = k \frac{\pi}{3}$, com $k \in \mathbb{Z}$

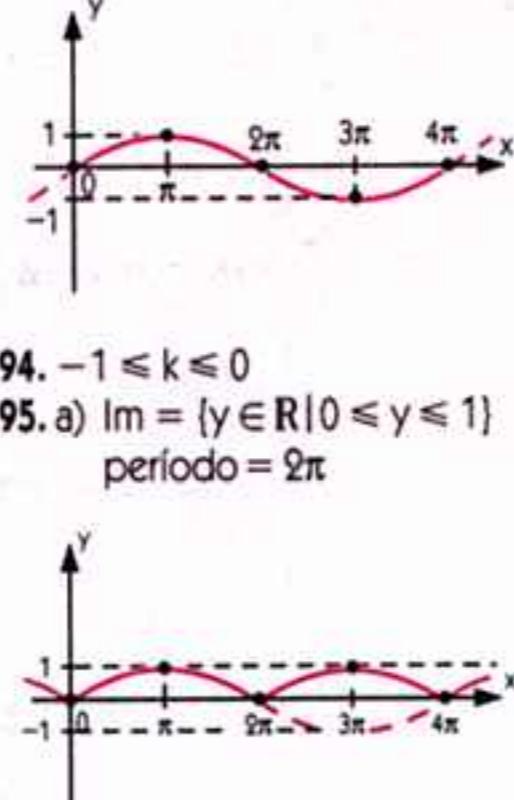
491. a) -1 d) -1 g) -1
b) 0 e) 0 h) 1

492. a) $-4 \leq k \leq -2$
b) $-5 \leq k \leq -4$

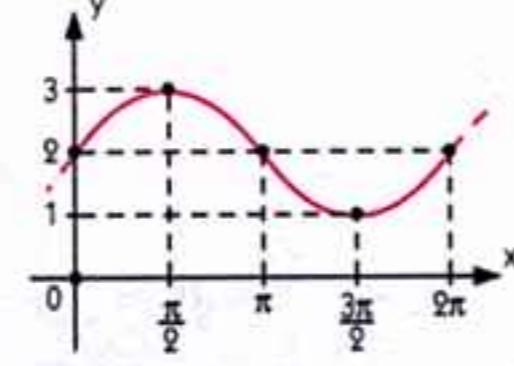
493. a) $\operatorname{Im} = \{y \in \mathbb{R} \mid -3 \leq y \leq 3\}$
período = 2π



b) $\operatorname{Im} = \{y \in \mathbb{R} \mid -1 \leq y \leq 1\}$
período = 4π



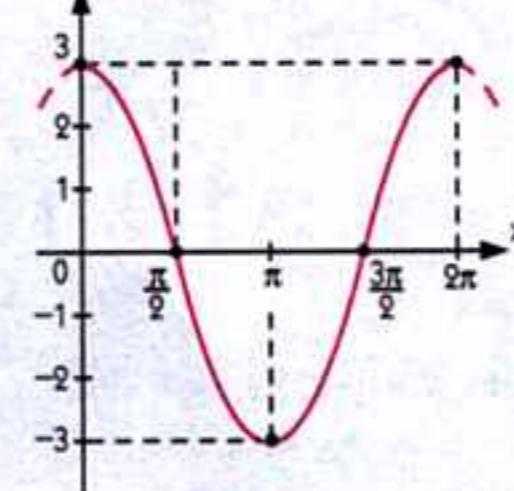
494. $-1 \leq k \leq 0$
495. a) $\operatorname{Im} = \{y \in \mathbb{R} \mid 0 \leq y \leq 1\}$
período = 2π



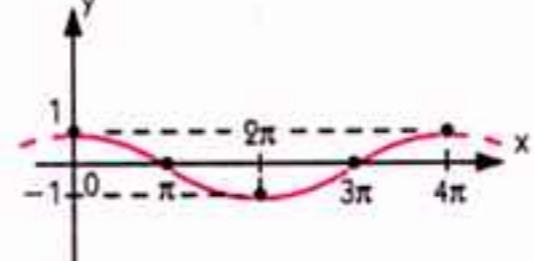
496. a) 0 c) 0 e) 0 g) -1
b) 1 d) 0 f) 1 h) -1

497. a) $-6 \leq k \leq -4$
b) $-4 \leq k \leq -3$

498. a) $\operatorname{Im} = \{y \in \mathbb{R} \mid -3 \leq y \leq 3\}$
período = 2π



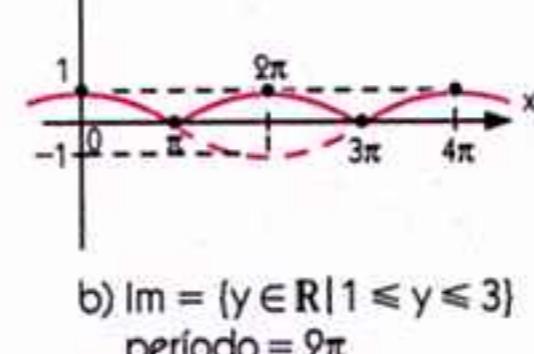
b) $\operatorname{Im} = \{y \in \mathbb{R} \mid -1 \leq y \leq 1\}$
período = 4π



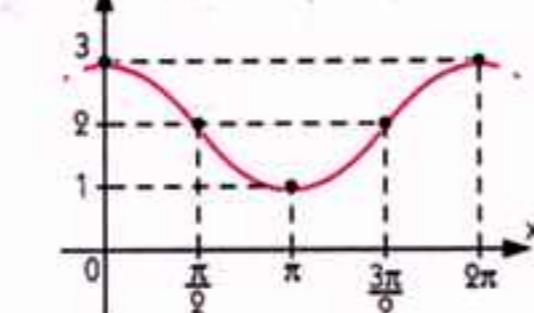
499. a) -2 b) 1 c) $-\frac{7}{2}$

500. $-2 \leq k \leq -1$ ou $0 \leq k \leq 1$

501. a) $\operatorname{Im} = \{y \in \mathbb{R} \mid 0 \leq y \leq 1\}$
período = 2π



b) $\operatorname{Im} = \{y \in \mathbb{R} \mid 1 \leq y \leq 3\}$
período = 2π



502. a) 1 b) 4
503. a) 0 c) 0

b) $\sqrt{3}$ d) -1

504. a) Não é definida. c) 1
b) 0 d) -1

505. a) falsa d) verdadeira
b) falsa e) falsa
c) verdadeira f) verdadeira

506. a) Não é definida. c) $\frac{\sqrt{3}}{3}$
b) $\sqrt{3}$ d) 0

507. a) 0 c) 1
b) Não é definida. d) -1

508. a) 1 d) -2
b) $\frac{2\sqrt{3}}{3}$ e) $-\sqrt{2}$

c) $\sqrt{2}$ f) $-\frac{2\sqrt{3}}{3}$

509. a) -1 d) $\frac{2\sqrt{3}}{3}$
b) Não é definida. e) $\sqrt{2}$

c) 1 f) 2

510. a) $2 - \sqrt{2}$
b) $2(\sqrt{3} - 1)$

c) 0

511. a) 1 b) -1
512. a) Não é definida. d) $\sqrt{3}$
b) 2 e) 0

c) $\frac{2\sqrt{3}}{3}$

513. a) $\sqrt{2}$
b) 1

c) Não é definida.
d) 3

e) $\frac{-2 + \sqrt{2}}{2}$

514. a) $\frac{4}{5}$

d) $\frac{5}{4}$

b) $\frac{3}{4}$

e) $\frac{5}{3}$

c) $\frac{4}{3}$

d) $\frac{5}{4}$

b) $-\frac{3}{4}$

e) $-\frac{5}{3}$

c) $-\frac{4}{3}$

d) $-\frac{5}{4}$

516. $\operatorname{tg} x = \frac{\sqrt{3}}{3}$; $\sec x = -\frac{2\sqrt{3}}{3}$

517. a) 1

c) $\sec x$

b) $\operatorname{cossec} x$

d) $-\sqrt{3}$

518. a) $-\frac{2\sqrt{3}}{3}$

b) 0

519. $\cos x = \frac{1}{4}$

520. $\operatorname{sen} x = -\frac{1}{2}$

521. m = 2

522. k = -1 ou k = 2

523. a) $\sec x$

b) 1

c) $\sec x$

524. a

525. a

526. a) $-\frac{3\sqrt{2}}{2}$

b) -3

c) 0

527. a) $\sqrt{2} - 1$

b) 0

528. a) $-\frac{2\sqrt{3}}{3}$

b) 2

c) -4

529. a) $y = -\frac{2\sqrt{3}}{3}$

b) $y = \frac{5}{2}$

c) $y = 4$

530. a) $\frac{\sqrt{3}}{2}$

b) $-\frac{\sqrt{3}}{2}$

c) $\frac{\sqrt{2}}{2}$

531. a) $\frac{2\sqrt{3}}{3}$

b) $-\sqrt{3}$

c) -2

537. $\operatorname{tg}^2 x$

- a) $\frac{\sqrt{6} + \sqrt{2}}{4}$ b) $\frac{\sqrt{6} - \sqrt{2}}{4}$ c) $\frac{\sqrt{2} - \sqrt{6}}{4}$ d) $\frac{\sqrt{2}}{2}$

539. a) $\frac{\sqrt{2}}{2} (\cos x - \operatorname{sen} x)$

- b) $\cos x$
c) $-\operatorname{sen} x$
d) $-\cos x$
e) $\operatorname{sen} x$

540. a) $\frac{\sqrt{6} - \sqrt{2}}{4}$

- b) $-\frac{\sqrt{2} + \sqrt{6}}{4}$
c) $\frac{\sqrt{6} + \sqrt{2}}{4}$
d) $-\frac{\sqrt{2}}{2}$

541. a) $\frac{\sqrt{2}}{2} (\cos x + \operatorname{sen} x)$

- b) $\operatorname{sen} x$
c) $-\cos x$
d) $-\cos x$
e) $\operatorname{sen} x$

542. a) $2 + \sqrt{3}$
b) $-2 - \sqrt{3}$

543. a) $\cos x$ b) $-\cos x$ c) $\cos x$
d) $\cos^2 x$ e) $2 \operatorname{sen} x$ f) $-2 \cos x$

544. $2 - \sqrt{3}$

545. a) 0 b) $\operatorname{tg} x$ c) $\cos x$

546. c) $547. a$

548. a) $\frac{4\sqrt{6}}{25}$ b) $-\frac{23}{25}$ c) $-\frac{4\sqrt{6}}{23}$

549. a) $\frac{24}{25}$ b) $-\frac{7}{25}$ c) $-\frac{24}{7}$

550. a) 2 b) $\cos^2 a$

552. a) $2 \cos^2 x \cdot \operatorname{cotg} x$
b) $\operatorname{sen} 2x$
c) 1

553. demonstração

554. a) $2 \operatorname{sen} 60^\circ \cdot \cos 30^\circ$
b) $2 \operatorname{sen} 40^\circ \cdot \cos 30^\circ$
c) $2 \operatorname{sen} 20^\circ \cdot \cos 60^\circ$
d) $2 \cos 40^\circ \cdot \cos 30^\circ$

555. a) $-2 \operatorname{sen} 30^\circ \cdot \operatorname{sen} 5^\circ$
b) $2 \operatorname{sen} 2x \cdot \cos x$
c) $-2 \operatorname{sen} 2a \cdot \operatorname{sen} a$
d) $2 \operatorname{sen} t \cdot \cos 3t$

556. a) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{4} + k \cdot 2\pi, \text{ ou } x = \frac{3\pi}{4} + k \cdot 2\pi, \text{ com } k \in \mathbb{Z} \right\}$

b) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{2} + k \cdot 2\pi, \text{ com } k \in \mathbb{Z} \right\}$

c) $V = \{x \in \mathbb{R} \mid x = k\pi, \text{ com } k \in \mathbb{Z}\}$

557. a) $V = \left\{ x \in \mathbb{R} \mid x = \frac{7\pi}{6} + k \cdot 2\pi \text{ ou } x = \frac{11\pi}{6} + k \cdot 2\pi, \text{ com } k \in \mathbb{Z} \right\}$

b) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{4} + k \cdot 2\pi, \text{ com } k \in \mathbb{Z} \right\}$

c) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{9} + k \cdot 2\pi \text{ ou } x = \frac{2\pi}{9} + \frac{k\cdot 2\pi}{3}, \text{ com } k \in \mathbb{Z} \right\}$

d) $V = \left\{ x \in \mathbb{R} \mid x = \frac{3\pi}{8} + k\pi, \text{ com } k \in \mathbb{Z} \right\}$

558. a) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{4} + k \cdot 2\pi \text{ ou } x = \frac{7\pi}{4} + k \cdot 2\pi, \text{ com } k \in \mathbb{Z} \right\}$

b) $V = \{x \in \mathbb{R} \mid x = k \cdot 2\pi, \text{ com } k \in \mathbb{Z}\}$

c) $V = \{x \in \mathbb{R} \mid x = \pi + k \cdot 2\pi, \text{ com } k \in \mathbb{Z}\}$

d) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{6} + k \cdot \pi \text{ ou } x = \frac{5\pi}{6} + k\pi, \text{ com } k \in \mathbb{Z} \right\}$

559. a) $V = \left\{ x \in \mathbb{R} \mid x = \frac{k \cdot 2\pi}{3} \text{ ou } x = \frac{k \cdot 2\pi}{5}, \text{ com } k \in \mathbb{Z} \right\}$

b) $V = \left\{ x \in \mathbb{R} \mid x = \frac{k \cdot 2\pi}{3} \text{ ou } x = -\frac{2\pi}{3} + k \cdot 2\pi, \text{ com } k \in \mathbb{Z} \right\}$

c) $V = \left\{ x \in \mathbb{R} \mid x = \frac{5\pi}{6} + k\pi \text{ ou } x = \frac{7\pi}{6} + k\pi, \text{ com } k \in \mathbb{Z} \right\}$

d) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{3} + \frac{k \cdot 2\pi}{3}, \text{ com } k \in \mathbb{Z} \right\}$

560. a) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{4} + k\pi, \text{ com } k \in \mathbb{Z} \right\}$

b) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{6} + k\pi, \text{ com } k \in \mathbb{Z} \right\}$

c) $V = \left\{ x \in \mathbb{R} \mid x = \frac{3\pi}{4} + k\pi, \text{ com } k \in \mathbb{Z} \right\}$

d) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{6} + \frac{k\pi}{2}, \text{ com } k \in \mathbb{Z} \right\}$

561. a) $V = \left\{ x \in \mathbb{R} \mid x = \frac{5\pi}{6} + k\pi, \text{ com } k \in \mathbb{Z} \right\}$

b) $V = \left\{ x \in \mathbb{R} \mid x = -\frac{\pi}{8} + \frac{k\pi}{2}, \text{ com } k \in \mathbb{Z} \right\}$

c) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{12} + \frac{k\pi}{3}, \text{ com } k \in \mathbb{Z} \right\}$

d) $V = \left\{ x \in \mathbb{R} \mid x = \frac{2\pi}{3} + \frac{k\pi}{2}, \text{ com } k \in \mathbb{Z} \right\}$

562. a) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{2} + k \cdot 2\pi, \text{ com } k \in \mathbb{Z} \right\}$

b) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{2} + k\pi \text{ ou } x = k \cdot 2\pi, \text{ com } k \in \mathbb{Z} \right\}$

c) $V = \left\{ x \in \mathbb{R} \mid x = k \cdot 2\pi \text{ ou } x = \pm \frac{\pi}{3} + k \cdot 2\pi, \text{ com } k \in \mathbb{Z} \right\}$

d) $V = \left\{ \frac{\pi}{6}, \frac{5\pi}{6}, \frac{3\pi}{2} \right\}$

e) $V = \left\{ 0, \frac{\pi}{6}, \frac{5\pi}{6}, \pi \right\}$

563. a)

564. $V = \{x \in \mathbb{R} \mid x = k \cdot 2\pi, \text{ com } k \in \mathbb{Z}\}$

565. a) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{2} + k \cdot 2\pi \text{ ou } x = \pi + k \cdot 2\pi, \text{ com } k \in \mathbb{Z} \right\}$

b) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{3} + k \cdot 2\pi \text{ ou } x = \frac{4\pi}{3} + k \cdot 2\pi, \text{ com } k \in \mathbb{Z} \right\}$

c) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{4} + k \cdot \pi, \text{ com } k \in \mathbb{Z} \right\}$

d) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{3} + k \cdot 2\pi \text{ ou } x = \frac{2\pi}{3} + k \cdot 2\pi, \text{ com } k \in \mathbb{Z} \right\}$

e) $V = \left\{ x \in \mathbb{R} \mid x = k \cdot 2\pi \text{ ou } x = \pm \frac{\pi}{3} + k \cdot 2\pi, \text{ com } k \in \mathbb{Z} \right\}$

566. a) $V = \left\{ x \in \mathbb{R} \mid x = \frac{k\pi}{2} \text{ ou } x = \frac{\pi}{2} + k\pi, \text{ com } k \in \mathbb{Z} \right\}$

b) $V = \left\{ x \in \mathbb{R} \mid x = k \cdot 2\pi \text{ ou } x = \frac{\pi}{3} + \frac{k \cdot 2\pi}{3}, \text{ com } k \in \mathbb{Z} \right\}$

c) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{3} + \frac{k \cdot 2\pi}{3} \text{ ou } x = \pi + k \cdot 2\pi, \text{ com } k \in \mathbb{Z} \right\}$

567. a) $V = \left\{ x \in \mathbb{R} \mid x = \frac{k\pi}{3} \text{ ou } x = k\pi, \text{ com } k \in \mathbb{Z} \right\}$

b) $V = \left\{ x \in \mathbb{R} \mid x = \pm \frac{\pi}{3} + k \cdot 2\pi \right\}$

c) $V = \left\{ 0, \frac{\pi}{3}, \frac{\pi}{2}, \frac{2\pi}{3}, \pi, \frac{3\pi}{2}, \frac{5\pi}{3} \right\}$

568. a) $V = \{x \in \mathbb{R} \mid 0 \leq x \leq 2\pi\}$

b) $V = \left\{ x \in \mathbb{R} \mid 0 \leq x \leq 2\pi \text{ e } x \neq \frac{3\pi}{2} \right\}$

c) $V = \{x \in \mathbb{R} \mid 0 < x < \pi\}$

d) $V = \{x \in \mathbb{R} \mid \pi < x < 2\pi\}$

569. a) $V = \left\{ x \in \mathbb{R} \mid \frac{\pi}{6} + k \cdot 2\pi < x < \frac{5\pi}{6} + k \cdot 2\pi, \text{ onde } k \in \mathbb{Z} \right\}$

b) $V = \left\{ x \in \mathbb{R} \mid k \cdot 2\pi \leq x < \frac{\pi}{6} + k \cdot 2\pi \text{ ou } \frac{5\pi}{6} + k \cdot 2\pi < x < 2\pi + k \cdot 2\pi, \text{ onde } k \in \mathbb{Z} \right\}$

c) $V = \left\{ x \in \mathbb{R} \mid k \cdot 2\pi \leq x < \frac{4\pi}{3} + k \cdot 2\pi \text{ ou } \frac{5\pi}{3} + k \cdot 2\pi < x < 2\pi + k \cdot 2\pi \right\}$

d) $V = \left\{ x \in \mathbb{R} \mid \frac{4\pi}{3} + k \cdot 2\pi \leq x < \frac{5\pi}{3} + k \cdot 2\pi, \text{ onde } k \in \mathbb{Z} \right\}$

e) $V = \left\{ x \in \mathbb{R} \mid k \cdot 2\pi \leq x < \frac{\pi}{3} + k \cdot 2\pi \text{ ou } \frac{2\pi}{3} + k \cdot 2\pi < x < 2\pi + k \cdot 2\pi, \text{ onde } k \in \mathbb{Z} \right\}$

f) $V = \left\{ x \in \mathbb{R} \mid \frac{\pi}{6} + k \cdot 2\pi \leq x < \frac{\pi}{3} + k \cdot 2\pi \text{ ou } \frac{2\pi}{3} + k \cdot 2\pi \leq x < \frac{5\pi}{6} + k \cdot 2\pi, \text{ onde } k \in \mathbb{Z} \right\}$

g) $V = \left\{ x \in \mathbb{R} \mid x = \frac{\pi}{2} \text{ ou } \pi \leq x \leq 2\pi \right\}$

570. b

571. a) $V = \left\{ x \in \mathbb{R} \mid 0 \leq x \leq \frac{\pi}{2} \text{ ou } \frac{3\pi}{2} \leq x < 2\pi \right\}$

b) $V = \{x \in \mathbb{R} \mid 0 < x < 2\pi\}$

c) $V = \{x \in \mathbb{R} \mid 0 \leq x < \pi \text{ ou } \pi < x < 2\pi\}$

d) $V = \left\{ x \in \mathbb{R} \mid 0 \leq x \leq \frac{\pi}{3} \text{ ou } \frac{5\pi}{3} \leq x < 2\pi \right\}$

572. a) $V = \left\{ x \in \mathbb{R} \mid 0 < x < \frac{\pi}{2} \text{ ou } \frac{3\pi}{2} < x < 2\pi \right\}$

b) $V = \left\{ x \in \mathbb{R} \mid \frac{\pi}{2} < x < \frac{3\pi}{2} \right\}$

c) $V = \left\{ x \in \mathbb{R} \mid 0 < x < \frac{\pi}{2} \text{ ou } \frac{3\pi}{2} < x < 2\pi \right\}$

d) $V = \left\{ x \in \mathbb{R} \mid \frac{\pi}{3} < x < \frac{5\pi}{6} \text{ ou } \frac{7\pi}{6} < x < \frac{5\pi}{3} \right\}$

573. a) $V = \left\{ x \in \mathbb{R} \mid k \cdot 2\pi \leq x < \frac{\pi}{3} + k \cdot 2\pi \text{ ou } \frac{5\pi}{3} + k \cdot 2\pi < x \leq 2\pi + k \cdot 2\pi, \text{ onde } k \in \mathbb{Z} \right\}$

b) $V = \left\{ x \in \mathbb{R} \mid \frac{\pi}{3} + k \cdot 2\pi \leq x < \frac{5\pi}{3} + k \cdot 2\pi, \text{ onde } k \in \mathbb{Z} \right\}$

c) $V = \left\{ x \in \mathbb{R} \mid k \cdot 2\pi \leq x < \frac{3\pi}{4} + k \cdot 2\pi \text{ ou } \frac{5\pi}{4} + k \cdot 2\pi < x \leq 2\pi + k \cdot 2\pi, \text{ onde } k \in \mathbb{Z} \right\}$

d) $V = \left\{ x \in \mathbb{R} \mid \frac{3\pi}{4} + k \cdot 2\pi < x < \frac{5\pi}{4} + k \cdot 2\pi, \text{ onde } k \in \mathbb{Z} \right\}$

e) $V = \left\{ x \in \mathbb{R} \mid -\frac{\pi}{3} + 2k\pi \leq x \leq \frac{\pi}{3} + 2k\pi, \text{ onde } k \in \mathbb{Z} \right\}$

574. a) $V = \left\{ x \in \mathbb{R} \mid \frac{\pi}{4} < x < \frac{\pi}{2} \text{ ou } \frac{5\pi}{4} < x < \frac{3\pi}{2} \right\}$

b) $V = \left\{ x \in \mathbb{R} \mid \frac{\pi}{2} < x < \frac{5\pi}{4} \text{ ou } \frac{3\pi}{2} < x \leq 2\pi \text{ ou } 0 \leq x < \frac{\pi}{4} \right\}$

c) $V = \left\{ x \in \mathbb{R} \mid \frac{\pi}{6} < x < \frac{\pi}{2} \text{ ou } \frac{7\pi}{6} < x < \frac{3\pi}{2} \right\}$

d) $V = \left\{ x \in \mathbb{R} \mid 0 < x < \frac{\pi}{6} \text{ ou } \frac{2\pi}{3} \leq x < \frac{7\pi}{6} \text{ ou } \frac{5\pi}{3} < x < 2\pi \right\}$

e) $V = \left\{ x \in \mathbb{R} \mid \frac{\pi}{4} < x \leq \frac{\pi}{3} \text{ ou } \frac{5\pi}{4} < x \leq \frac{4\pi}{3} \right\}$

576. a) $a = \sqrt{2}$

b) $b = \frac{\sqrt{6} - \sqrt{2}}{2}$

577. $R = 2$

578. $20 + 10\sqrt{3}$

579. $36m$

580. $c = 2\sqrt{3}$

581. $d = 2\sqrt{7}$

582. $c = 60^\circ$

583. a) acutângulo

b) retângulo

c) obtusângulo

584. $a = \frac{\sqrt{6} + \sqrt{2}}{2} \text{ cm}$

área = $\frac{3 + \sqrt{3}}{4} \text{ cm}^2$

585. $C = 30^\circ$

586. $B = 150^\circ$

Exercícios complementares

587. a) $\frac{m\sqrt{3}}{2}$

e) $\frac{\sqrt{3}}{2}$

b) $\frac{1}{2}$

f) $\frac{1}{2}$

c) $\frac{\sqrt{3}}{2}$

g) $\sqrt{3}$

d) $\frac{\sqrt{3}}{3}$

588. a) $a\sqrt{2}$

c) $\frac{\sqrt{2}}{2}$

b) $\frac{\sqrt{2}}{2}$

d) 1

589. a) $x = 8$ e $y = 8\sqrt{3}$

b) $x = \frac{8\sqrt{3}}{3}$ e $y = \frac{4\sqrt{3}}{3}$

590. $h = 81,6$

591. b

592. $10\sqrt{3}$

593. c

594. a) I

d) III

g) III

b) II

e) I

c) II

f) III

h) IV

595. b) $\frac{12}{13}$

596. c) $-\frac{13}{5}$

597. c) $-\frac{5}{12}$

598. a) $\frac{12}{13}$

d) $-\frac{13}{5}$

599. a) $y = 15$

600. e) 15

601. e) 15

602. b) 15

603. b) 15

604. d) $m = 0$

605. m = 0

606. d) 0

607. a) $y = 0$

b) $y = \operatorname{cossec} x$

608. e) $609. b$

610. d) $609. b$

611. b) $612. \sqrt{2}$

613. b) $612. \sqrt{2}$

614. c) $615. e$

616. e) $615. e$

617. b) $618. c$

619. d) $618. c$

620. d) $621. a$

621. a) $622. e$

622. e) $623. c$

623. e) $624. c$

624. c) $-\frac{\sqrt{2}}{2}$

625. a) $-\frac{\sqrt{2}}{2}$

c) $\frac{\sqrt{3}}{3}$

b) $-\frac{\sqrt{2}}{2}$

626. a) 1

b) $\frac{\sqrt{3}}{2}$

c) \exists

627. a) $628. a$

629. b) $-2 \leq m \leq 2$

630. d) $631. c$

631. c) $632. c$

633. demonstração

634. a) $-\frac{\sqrt{3}}{2}$

c) $-\sqrt{3}$

b) $\frac{1}{2}$

635. a)

636. c)

637. b)

638. d)

639. A = -21

640. a) $\cos 10^\circ$

b) $-\sin 5^\circ$

648. b

649. a) $V = \left\{ 0; \frac{\pi}{2}; 2\pi \right\}$

b) $V = \left\{ x \in \mathbb{R} \mid x = -\frac{\pi}{6} + k \cdot 2\pi \text{ ou } x = \frac{\pi}{2} + k \cdot 2\pi; k \in \mathbb{Z} \right\}$

650. b 651. e 652. d

PROGRESSÕES**Exercícios propostos**

- a) 2, 3, 4 e 5
b) 1, 4, 7 e 10
c) 2, 4, 8 e 16
d) $\frac{1}{4}, \frac{1}{2}, 1 \text{ e } 2$
e) 5, 8, 13 e 20
f) 6, 18, 54 e 162

654. $a_{14} = \frac{1}{16}$ 655. $a_4 = 250$

656. $-8 \text{ e } -18$

- a) $a_n = 4n$
b) $a_n = -3 + 4n$
c) $a_n = 1 + 4n$
658. a) crescente ($r = 2$)
b) Não é P.A.
c) decrescente ($r = -4$)
d) Não é P.A.
e) crescente ($r = 5$)
f) crescente ($r = \frac{1}{2}$)
g) crescente ($r = 2$)
h) constante ($r = 0$)

659. a) $a_5 = 16$ c) $a_{35} = 34$

b) $a_7 = -5$ d) $a_4 = \frac{13}{6}$

660. $a_{20} = 134$ 661. $a_{17} = 74$

662. $a_8 = \frac{9}{2}$ 663. $a_1 = 6$

664. $r = 10$ 665. $a_1 = -7$

666. $r = \frac{122}{25}$ 667. $n = 21$

668. É P.A. nessas condições, ou seja, 184 não pode ser termo da progressão dada.

669. $n = 18$

670. $a_1 = 6; r = 6$

671. P.A. (6, 9, 12, ...)

672. P.A. (-3, -4, -5, ...)

673. $x = 1$

674. $n = 12$

675. $n = 180$

676. P.A. (70, 80, 90, ...)

677. $x = -\frac{7}{2}$

678. a) $n = 142$ b) $n = 129$

679. $a_{24} = \frac{41\sqrt{3} + 67}{5}$

680. para $r = 3 \Rightarrow (-4, -1, 2)$

para $r = -3 \Rightarrow (2, -1, -4)$

681. para $r = 3 \Rightarrow (-1, 2, 5)$

para $r = -3 \Rightarrow (5, 2, -1)$

682. 40°

683. -2, 0, 2, 4 e 6

684. 2, 5, 8, 11 e 14

685. P.A. (11, 14, 17, 20, 23, 26)

686. P.A. (-2, 3, 8, 13, 18, 23, 28, 33, 38, 43)

687. P.A. (60, 55, 50, 45, 40, 35, 30, 25, 20, 15, 10, 5, 0, -5)

688. P.A. $\left(\frac{3}{4}, -\frac{43}{78}, -\frac{55}{156}, -\frac{6}{39}, \frac{7}{156}, \frac{19}{78}, \frac{23}{52}, \frac{25}{39}, \frac{131}{156}, \frac{27}{26}, \frac{193}{156}, \frac{56}{39}, \frac{85}{52}, \frac{11}{6} \right)$

689. a) 6 b) 83

690. $S_{18} = 477$

691. $S_{25} = -775$

692. $S_{30} = 1290$

693. $S_{50} = 2500$

694. $S_{30} = 1665$

695. $S_{140} = 71050$

696. $S_{50} = 2550$

697. P.A. (-5, -10, -15, ...)

$S_{20} = -1050$

698. $S_{20} = -245$

699. a) $S_{10} = 100$ b) $S_n = n^2$

700. $n = 6$ e $a_1 = 4$

701. $a_1 = 4$ e $S_{10} = 130$

702. $a_1 = -2$ e $n = 11$ ou

$a_1 = 4$ e $n = 8$

703. $S_{33} = 594$

704. $S_{18} = 1197$

705. $n = 20$

706. b

707. a) $q = 3$ f) $q = -\frac{1}{2}$

b) $q = \frac{1}{2}$ g) $q = x$

c) $q = 1$ h) $q = a^9b$

d) $q = 4$ i) $q = -\sqrt{5}$

e) $q = 4$ j) $q = \sqrt{7}$

708. a) $-7, -14, -28, -56 \text{ e } -112$

b) $\frac{9}{5}, \frac{1}{25}, \frac{1}{250}, \frac{1}{2500} \text{ e } \frac{1}{25000}$

c) $ab, a^3b^4, a^5b^7, a^7b^{10} \text{ e } a^9b^{13}$

d) $-80, 20, -5, \frac{5}{4} \text{ e } -\frac{5}{16}$

e) $\sqrt{3}, 1, \frac{\sqrt{3}}{3}, \frac{1}{3} \text{ e } \frac{\sqrt{3}}{9}$

f) $0,5; -0,1; 0,02; -0,004 \text{ e } 0,0008$

709. a) decrescente

b) crescente

c) crescente

d) alternante

e) decrescente

f) crescente

g) crescente

h) estacionária

i) crescente

j) decrescente

710. b 711. b

712. $a_{10} = 512$ 713. $a_8 = 3^7$

714. $a_9 = 16$ 715. $a_1 = \frac{1}{2}$

716. $a_1 = 128$ 717. $q = \pm 2$

718. $q = \frac{2}{3}$ 719. $n = 9$

720. $n = 6$

721. sétimo termo

722. sexto termo 723. $x = \pm 3$

724. $x = 12$ 725. $x = \frac{9}{8}$

726. $n = -\frac{1}{8}$ 727. $n = 10$

728. A igualdade é falsa.

729. $a_8 = 8\sqrt{2}$ e $a_n = 2^{\frac{n-1}{2}}$

730. $a_3 = 20$ 731. $a_3 = 72$

732. 5, 15, 45 e 135

733. 5, 10 e 20

734. 2, 6 e 18

735. P.G. (3, 6, 12, ...)

736. $S_7 = 1093$

737. $S_8 = 510$

738. $S_{10} = -3069$

739. $S_6 = \frac{364}{81}$

740. $S_{11} = \frac{9047}{32}$

741. $S_6 = 315$ 742. $S_5 = -121$

743. $S_7 = 635$ 744. $S_{10} = 0$

745. $S_n = 1365$ 746. $n = 9$

747. a) $S = \frac{3}{4}$ d) $S = 200$

b) $S = \frac{9}{2}$ e) $S = 2a^2$

c) $S = \frac{10}{9}$

748. a) $\frac{5}{9}$ c) $\frac{31}{9}$
b) $\frac{4}{33}$ d) $-\frac{8}{3}$

749. a 750. b

751. a) $V = \{-3, 1\}$
b) $V = \{0, 2\}$

752. $S = \frac{a^2\sqrt{3}}{3}$

753. b 754. a

755. a) $P_6 = 2^{21}$
b) $P_6 = 2^{21}$

c) $P_6 = -3^{15}$

d) $P_6 = \frac{1}{125}$

e) $P_6 = 2^{-21}$

756. $P_{16} = 5^{56}$

757. $P_{141} = 2^{1974}$

758. b •

Exercícios complementares

759. $a_{12} = 37$ 760. $a_{20} = \frac{79}{12}$

761. $a_1 = r = -5$ 762. $r = 3$

763. $a_1 = 3$ 764. $S_{27} = 729$

765. e 766. b

767. c 768. d

769. d

770. b) $a_5 = 1986$

771. b 772. b

773. $S_{20} = -245$

774. $S_{100} = 10000$

775. $S_{100} = 9900$

776. $a_{10} = -8$

777. $a_9 = -729$

778. $x = 2$ e $a_4 = 27$

779. $S_8 = 425$

780. $S_n = 1098$

781. $S = -\frac{4}{5}$

782. $m = 7$

783. a) 784. d)

785. d) 786. d)

787. b) 788. $x = 24$

789. e) 790. d)

791. a) R\$ 19 500,00

b) 50 pagamentos

MATRIZES

Exercícios propostos

792. $A = \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$

793. $B = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

794. $C = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \end{bmatrix}$

796. $M^t = \begin{bmatrix} 2 & 1 & 2 \\ -1 & 4 & 1 \end{bmatrix}_{2 \times 3}$

$(-M^t)^t = \begin{bmatrix} -2 & 1 \\ -1 & -4 \\ -2 & -1 \end{bmatrix}_{3 \times 2}$

797. a) 2 c) 2
b) 0 d) 20

798. $A = \begin{bmatrix} 1 & 1 \\ -1 & 0 \end{bmatrix}$

799. c)

800. a) $x = 6$; $y = 4$
b) $x = y = 1$
c) $x = 4$; $y = 6$

801. $x = 0$; $y = 0$ ou $x = 1$; $y = 0$

802. a) $\begin{bmatrix} 8 & 11 \\ -1 & -5 \end{bmatrix}$

b) $\begin{bmatrix} 3 & 6 \\ -5 & 3 \end{bmatrix}$

c) $\begin{bmatrix} 9 & 14 \\ 3 & -11 \end{bmatrix}$

d) $\begin{bmatrix} -16 & -19 \\ 19 & -11 \end{bmatrix}$

e) $\begin{bmatrix} 25 & 16 \\ -31 & 23 \end{bmatrix}$

803. a) $\begin{bmatrix} -5 & 4 & 6 \\ 6 & 2 & -2 \end{bmatrix}$

b) $\begin{bmatrix} 18 \\ -1 \end{bmatrix}$

c) $\begin{bmatrix} -7 & -7 \\ -12 & -1 \end{bmatrix}$

d) $\begin{bmatrix} 6 & -2 \\ -2 & -12 \end{bmatrix}$

804. a) $\begin{bmatrix} 1 & -9 \\ 7 & 4 \end{bmatrix}$

b) $\begin{bmatrix} -1 & 9 \\ -7 & 4 \end{bmatrix}$

c) $\begin{bmatrix} 7 & 12 \\ 4 & 8 \end{bmatrix}$

d) $\begin{bmatrix} 5 & -20 \\ 20 & -8 \end{bmatrix}$

805. a) $x = 6$; $y = 11$

b) $x = -9$; $y = 8$
c) $x = -3$; $y = 2$

806. a) $X = \begin{bmatrix} -10 & -6 & 22 \\ 8 & -4 & 12 \end{bmatrix}$

$Y = \begin{bmatrix} 19 & 1 & -21 \\ 4 & 6 & 2 \end{bmatrix}$

b) $X = \begin{bmatrix} 9 & -5 & 1 \\ 12 & 2 & 14 \end{bmatrix}$

$Y = \begin{bmatrix} 11 & 0 & -19 \\ -4 & 4 & -7 \end{bmatrix}$

807. a) $X = \begin{bmatrix} -3 & -11 & 17 \\ 2 & 2 & -10 \end{bmatrix}$

b) $Y = \begin{bmatrix} 5 & -1 & 27 \\ 16 & 0 & -14 \end{bmatrix}$

c) $Z = \begin{bmatrix} 3 & -15 & -12 \\ \frac{15}{2} & 15 & -21 \end{bmatrix}$

808. a)

809. a) $\begin{bmatrix} 16 & -7 \\ -3 & 13 \end{bmatrix}$

b) $\begin{bmatrix} 6 & -5 \\ -18 & 41 \end{bmatrix}$

c) $\begin{bmatrix} 3 & -7 \\ -6 & 14 \end{bmatrix}$

d) $\begin{bmatrix} 3 & 19 \\ -25 & 9 \end{bmatrix}$

e) $\begin{bmatrix} -1 & 28 & -13 \\ 19 & -12 & 39 \\ 9 & -2 & 17 \end{bmatrix}$

f) $\begin{bmatrix} 20 & -2 & 20 \\ 56 & 14 & 43 \end{bmatrix}$

810. $A \cdot B = \begin{bmatrix} 4 & -13 & 5 \\ -12 & 21 & -9 \\ 0 & 45 & -15 \end{bmatrix}$

r) $\begin{bmatrix} -11 & 7 \\ -27 & 21 \end{bmatrix}$

811. $(M + N) \cdot P = \begin{bmatrix} -1 & -34 \\ -1 & -34 \end{bmatrix}$

812. $\begin{bmatrix} 1 & 2 \\ 3 & -1 \end{bmatrix}$

813. a) 1; b) 0 814. a)

815. d)

816. a) $P^2 = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$

$P^3 = \begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix}$

b) $P^n = \begin{bmatrix} 1 & n \\ 0 & 1 \end{bmatrix}$

817. a) $A^{-1} = \begin{bmatrix} -2 & 1 \\ 1 & 0 \end{bmatrix}$

b) $B^{-1} = \begin{bmatrix} 5 & -2 \\ -7 & 3 \end{bmatrix}$

c) $C^{-1} = \begin{bmatrix} 2 & -3 \\ -3 & 5 \end{bmatrix}$

d) $D^{-1} = \begin{bmatrix} \frac{5}{13} & \frac{1}{13} \\ \frac{3}{13} & \frac{2}{13} \end{bmatrix}$

818. $\begin{bmatrix} 1 & -1 \\ 1 & -2 \end{bmatrix}$ 819. a)

820. $\begin{bmatrix} \frac{1}{3} & \frac{2}{3} \\ \frac{5}{6} & \frac{1}{6} \end{bmatrix}$

821. $\begin{bmatrix} 6 & 3 \\ -5 & 15 \end{bmatrix}$ 822. c)

823. a) $\begin{bmatrix} 1 & \operatorname{sen} 2x \\ \operatorname{sen} 2x & 1 \end{bmatrix}$

b) 0 e 2π

824. b)

825. d)

Exercícios complementares

826. $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

827. $B = \begin{bmatrix} 4 & 9 & 16 \\ 9 & 16 & 25 \\ 16 & 25 & 36 \end{bmatrix}$

828. d) 829. e)

830. a) $\begin{bmatrix} -3 & 5 \\ -1 & -3 \\ 11 & 3 \end{bmatrix}$

b) $\begin{bmatrix} -2 & 2 \\ -7 & -12 \\ 11 & 3 \end{bmatrix}$

c) $\begin{bmatrix} 8 & -1 & -4 \\ -1 & 3 & 9 \end{bmatrix}$

d) $\begin{bmatrix} -2 & 1 \\ 9 & 13 \\ -6 & -5 \end{bmatrix}$

831. $x = 7$; $y = 3$

832. a) $\begin{bmatrix} 18 & 15 \\ 4 & 5 \end{bmatrix}$

b) $\begin{bmatrix} 8 & -11 & 3 \\ 6 & 3 & 11 \\ 0 & 9 & 7 \end{bmatrix}$

c) $\begin{bmatrix} -19 & -10 & -10 \\ 9 & 10 & 11 \end{bmatrix}$

833. $\begin{bmatrix} 1 & -2 \\ -2 & 1 \end{bmatrix}$

834. $\begin{bmatrix} 11 & 14 \\ -10 & -14 \end{bmatrix}$

835. $\begin{bmatrix} 7 & 0 \\ 0 & 7 \end{bmatrix}$

836. $C_{12} = -6$

837. a) $\begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix}$

b) $\begin{bmatrix} \frac{2}{7} & \frac{3}{7} \\ -\frac{1}{7} & \frac{2}{7} \end{bmatrix}$

838. $\begin{bmatrix} -11 & -9 \\ 12 & -8 \end{bmatrix}$

839. $\begin{bmatrix} \frac{1}{3} & 0 \\ \frac{4}{3} & -2 \end{bmatrix}$

840. $\begin{bmatrix} -\frac{1}{2} & \frac{9}{2} \\ -\frac{5}{2} & \frac{15}{2} \end{bmatrix}$

841. b) 842. e)

843. $\begin{bmatrix} \frac{31}{6} & \frac{35}{18} \\ \frac{35}{12} & \frac{151}{36} \end{bmatrix}$

844. demonstração

DETERMINANTES

Exercícios propostos

845. a) $\det A = 5$
 b) $\det B = \pi$
 c) $\det C = -6$
 d) $\det D = \frac{-3\sqrt{2}}{2}$
 e) $\det E = 0$
846. a) 7 d) 2
 b) 12 e) -1
 c) -7 f) 3
847. a) $\det A = -14$
 b) $\det B = 7$
 c) $\det C = -98$
848. a) 2 e) 19
 b) -3 f) 13
 c) -5 g) 2
 d) 0 h) 1
849. a) -4 d) 4
 b) 20 e) 0
 c) 78
850. a) $S = \{6\}$ c) $S = \{1\}$
 b) $S = \{-3\}$ d) $S = \{4\}$
851. a) $S = \{2\}$ c) $S = \{3\}$
 b) $S = \{8\}$ d) $S = \{2\}$
852. 22 853. $N = 50$
854. 64 855. $V = \{0, 3\}$
856. 93 857. e
858. a) -119 c) -236
 b) 159 d) 72
859. a) $S = \left\{ \frac{1}{6} \right\}$
 b) $S = \left\{ -\frac{39}{11} \right\}$
860. a
- Exercícios complementares
861. a) 6 c) -1
 b) 17 d) 7
862. a) -40 b) 20
 c) -60
863. a) $S = \left\{ -\frac{3}{8} \right\}$
 b) $S = \left\{ -\frac{3}{2} \right\}$
864. $V = \{3; 5\}$
865. a) 25 b) -10
866. 0
867. a) 2 b) -6
868. $V = \{0, 1\}$ 869. d
870. e 871. b
872. $V = \{-2, 0, 1\}$
873. c 874. $V = \{2, 8\}$
875. d 876. $\det A = 1$
877. b 878. c
879. d 880. a

SISTEMAS LINEARES

Exercícios propostos

881. a) Não é solução.
 b) É solução.
 c) Não é solução.
882. e
883. a) É solução.
 b) É solução.
 c) Não é solução.
884. a) $V = \{(2, 3)\}$
 b) $V = \{(1, -1)\}$
885. a) $V = \{(1, 2, 4)\}$
 b) $V = \{(-2, 3, 0)\}$
886. a) $V = \{(-1, 1, 2)\}$
 b) $V = \left\{ \left(\frac{2}{3}, 0, \frac{2}{3} \right) \right\}$
887. a) SPD
 b) SPI
 c) SI
888. a) sim
 b) não
 c) não
889. a) $\neq -\frac{8}{3}$
 b) $a = -1; b = 16$
 c) $k \neq 3$
890. Se $k \neq 6$, o sistema é SPD.
 Se $k = 6$, o sistema é impossível.
891. $k \neq 3$
892. a) $V = \{(\Omega k - 2, -k - 3, k), k \in \mathbb{R}\}$
 b) $V = \{(\Omega k, 3k, k), k \in \mathbb{R}\}$
893. a) SI; $V = \emptyset$
 b) SI; $V = \emptyset$
 c) SPD; $V = \{(6, -5, 1)\}$
 d) SPD; $V = \left\{ \left(\frac{5}{3}, \frac{5}{3}, -\frac{7}{3} \right) \right\}$
894. b
895. e
896. a) 1 ou a = -2
897. a) $V = \left\{ \left(\frac{3}{2}, \frac{3}{2}, -\frac{5}{2} \right) \right\}$
 b) $V = \emptyset$
 c) $V = \{(4 + k, -1 - k, k)\}$
898. 60 litros de leite com 3% de gordura; 20 litros de leite com 4% de gordura.
899. e 900. e
901. e 902. a

Exercícios complementares

903. a) SPD b) SI
 904. a) SPD b) SPI
 905. a) $\neq -2$ 906. $k = -2$
 907. m $\neq 3$ 908. $k \neq \frac{13}{2}$
 909. c 910. e
 911. c 912. c
 913. a 914. c
 915. a 916. b
- ANÁLISE COMBINATÓRIA
BINÔMIO DE NEWTON**
- Exercícios propostos
917. 10 918. 96
 919. 8 920. 45
 921. 80 922. 60
 923. $8 \cdot 10^6$ 924. e
 925. a 926. c
 927. a) 1 g) 4
 b) 1 h) 2
 c) 720 i) 12
 d) 5040 j) 120
 e) 8 l) 48
 f) 25
928. a) $\frac{1}{9}$ d) 3
 b) 210 e) $\frac{7}{3}$
 c) $\frac{1}{30}$ f) $\frac{1}{12}$
929. a) n d) $4x^2 + 6x + 2$
 b) $x^2 - x$ e) $x^2 + 2x$
930. a) 0 ou 1 c) 6
 b) 4 d) 1 ou 2
931. a) $V = \{3\}$
 b) $V = \{5\}$
 c) $V = \{2\}$
932. a 933. a
 934. b 935. $(n + 1)^2$
936. a) 120 b) 48
 c) 72
937. a) 720 b) 120
938. 240 939. 720
 940. 120 941. b
 942. e 943. e
 944. a) 24 c) 1320
 b) 20 d) $\frac{1}{60}$
945. a) $V = \{6\}$
 b) $V = \{11\}$
 c) $V = \{6\}$
946. 60 947. 3360
 948. 6720 949. 42
 950. d
 951. a) 9!
 b) 1728
 952. b 953. $\frac{20!}{14!}$
 954. a) 10 c) 15
 b) 21 d) 12
 955. a) $V = \{4\}$
 b) $V = \{19\}$
 956. 210 957. 15
 958. n = 6 959. 792
 960. 56 961. 15
 962. d 963. d
 964. 72 965. a
 966. e 967. d
 968. d 969. 90^o
 970. 10 971. 840
 972. $\frac{20!}{10! 6! 4!}$ 973. 10
 974. d 975. 161280
 976. 680 977. a) 15
 b) 5 c) 7
 d) 45
 978. a) 2 b) 3
 c) 5
 979. a) 20 b) 165
 980. a) $V = \{3, 4\}$
 b) $V = \{2, 6\}$
 c) $V = \{10\}$
 d) $V = \{7\}$
 e) $V = \{6\}$
 981. c 982. d
 983. b 984. e
 985. a
 986. $(S_0, S_1, S_2, S_3, S_4, S_5, S_6, \dots) =$
 $(1, 1, 2, 3, 5, 8, 13, \dots)$
 987. a) $x^3 + 6x^2 + 12x + 8$
 b) $x^4 + 12x^3 + 54x^2 +$
 c) $x^6 + 30x^5 + 375x^4 +$
 d) $x^3 - 3x^2 + 3x - 1$
 e) $x^6 - 18x^5 + 135x^4 -$
 f) $540x^3 + 1215x^2 -$
 g) $-1458x + 729$
 h) $x^5 - 5x^4 + 10x^3 - 10x^2 +$
 i) $+ 5x - 1$
 988. a) $T_4 = 160x^3$
 b) $T_6 = 13608x^3$

989. a) $T_3 = 84x^5$
b) $T_2 = -6x^5$

990. $T_2 = 24x^7$

991. $T_4 = -35x^4$

992. b 993. b

994. e 995. c

996. 22 320

997. a 998. a

999. a 1000. d

1001. c 1002. a

1003. a 1004. b

Exercícios complementares

1005. 12 1006. 60

1007. a) $\frac{1}{72}$ d) 19

b) 168 e) $n + 1$

c) $\frac{31}{30}$ f) n

1008. a) $V = \{2\}$ b) $V = \{1\}$

1009. d 1010. d

1011. d 1012. c

1013. e 1014. c

1015. 6 1016. 11 880

1017. 504 1018. 5

1019. e

1020. a) 10 b) 7

1021. a) $V = \{3, 8\}$
b) $V = \emptyset$

1022. a) 56 b) 36

1023. $V = \{n \in \mathbb{N} \mid n \geq 6\}$

1024. c

1025. a) $x^6 + 18x^5 + 135x^4 +$
+ $540x^3 + 1915x^2 +$
+ $1458x + 729$

b) $x^5 - 5x^4 + 10x^3 -$
- $10x^2 + 5x - 1$

1026. e 1027. d

1028. b 1029. c

1030. b 1031. b

1032. a 1033. a

PROBABILIDADE

Exercícios propostos

1034. a)

v \ A	1	2	3	4	5	6
1	(1, 1)	(1, 2)	(1, 3)	(1, 4)	(1, 5)	(1, 6)
2	(2, 1)	(2, 2)	(2, 3)	(2, 4)	(2, 5)	(2, 6)
3	(3, 1)	(3, 2)	(3, 3)	(3, 4)	(3, 5)	(3, 6)
4	(4, 1)	(4, 2)	(4, 3)	(4, 4)	(4, 5)	(4, 6)
5	(5, 1)	(5, 2)	(5, 3)	(5, 4)	(5, 5)	(5, 6)
6	(6, 1)	(6, 2)	(6, 3)	(6, 4)	(6, 5)	(6, 6)

S = {(1, 1), (1, 2), (1, 3),
... (6, 6)} e n(S) = 6 · 6 = 36

b) E₁ = {(1, 4), (2, 3), (3, 2),
(4, 1)}

c) E₂ = {(1, 1), (2, 2), (3, 3),
(4, 4), (5, 5), (6, 6)}

d) E₃ = {(1, 1), (1, 3), (1, 5),
(2, 2), (2, 4), (2, 6),
(3, 1), (3, 3), (3, 5),
(4, 2), (4, 4), (4, 6)}

e) E₄ = {(1, 1), (1, 3), (1, 5),
(3, 1), (3, 3), (3, 5),
(5, 1), (5, 3), (5, 5)}

f) E₅ = {(2, 1), (2, 2), (2, 3),
(2, 4), (2, 5), (2, 6),
(1, 2), (3, 2), (4, 2),
(5, 2), (6, 2)}

g) E₆ = S - {(6, 6)}

h) E₇ = \emptyset

i) E₈ = {(1, 1)}

1035. a) E₁ = {(F, F, F)}

b) E₂ = {(M, M, M), (M, M, F),
(M, F, M), (M, F, F), (F, M, M),
(F, M, F), (F, F, M)}

c) E₃ = {(M, M, M), (F, F, F)}

1036. a) E₁ = {1, 3, 5, 7, 9, 11,
13, 15, 17, 19}

b) E₂ = {16, 17, 18, 19, 20}

c) E₃ = {5, 10, 15, 20}

d) E₄ = {6, 12, 18}

e) E₅ = {2, 3, 5, 7, 11, 13,
17, 19}

f) E₆ = {6, 12, 18}

g) E₇ = {7}

1037. $\frac{1}{6}$

1038. $\frac{1}{2}$

1039. $\frac{7}{8}$

1040. $\frac{1}{4}$

1041. d

1042. p = $\frac{3}{11}$

1043. d

1044. a) $\frac{1}{6}$ e) $\frac{35}{36}$

b) $\frac{1}{9}$ f) 0

c) $\frac{1}{2}$ g) $\frac{1}{4}$

d) $\frac{3}{4}$

1045. a) $\frac{10}{21}$ b) $\frac{10}{21}$

1046. $\frac{1}{3}$

1047. $\frac{12}{17}$

1048. $\frac{1}{2}$

1049. $\frac{1}{2}$

1050. a) $\frac{14}{25}$ c) $\frac{43}{50}$

b) $\frac{1}{2}$

1051. b

1052. $\frac{11}{20}$

1053. $\frac{1}{36}$

1054. $\frac{1}{27}$

1055. p = $\frac{1}{60}$

1056. c

1057. P(A ∩ B) = $\frac{1}{36}$

1058. d

Exercícios complementares

1059. b

1060. $\frac{3}{8}$

1061. c

1062. a) $\frac{1}{6}$

c) $\frac{5}{36}$

b) $\frac{6}{11}$

1063. a

1064. b

1065. a) 87 500 pares

b) $\frac{2}{7}$

1066. 73%

1067. d

1068. a

1069. a) x = 11

b) $\frac{7}{25}$

1070. I) b II) a

1071. $\frac{2}{9}$

GEOMETRIA ESPACIAL

Exercícios propostos

1072. a

1073. d

1074. a) x = 17°

b) x = 20°

1075. e

1076. b

1077. e

1078. a

1079. a

1080. a

1081. b

1082. d

1083. d

1084. 25,6 m

1085. e

1086. b

1087. b

1088. c

1089. b

1090. d

1091. 30 cm

1092. d

1093. c

1094. $2\sqrt{13}$ dm

1095. d

1096. a = 2, b = $\sqrt{6}$

1097. a

1098. a) 19 202 cm²

1142. $m = \frac{5\sqrt{3}}{2}$ cm;
 $A_T = 25\sqrt{3} \text{ cm}^2$
 1143. $A_b = 36 \text{ m}^2$; $A_T = 96 \text{ m}^2$;
 $V = 48 \text{ m}^3$
 1144. c 1145. a
 1146. c
 1147. a) $\frac{1}{2}$ b) $\sqrt{3}$
 1148. 3 cm 1149. 16 dm
 1150. a 1151. c
 1152. b 1153. $h = \frac{45}{7}$ dm
 $V = 70\sqrt{3} \text{ cm}^3$
 1155. d 1156. 3 m
 1157. c 1158. b
 1159. a) $A_b = 4\pi \text{ m}^2$
 b) $A_T = 24\pi \text{ m}^2$
 c) $A_T = 32\pi \text{ m}^2$
 d) $V = 24\pi \text{ m}^3$
 1160. a) $A_T = 72\pi \text{ cm}^2$
 b) $V = 81\pi \text{ cm}^3$
 1161. a) $r = 3 \text{ dm}$
 b) $h = 6 \text{ dm}$
 c) $A_T = 54\pi \text{ dm}^2$
 1162. a) $h = 12 \text{ cm}$
 b) $A_T = 216\pi \text{ cm}^2$
 c) $V = 432\pi \text{ cm}^3$
 1163. $A_T = 36\pi \text{ cm}^2$; $V = 28\pi \text{ cm}^3$
 1164. $h = 9 \text{ m}$ 1165. b
 1166. d 1167. c
 1168. Faria transbordar o outro copo, porque o seu volume corresponde ao dobro do outro.
 1169. a) na embalagem A
 b) a embalagem B
 1170. a) $A_T = 60\pi \text{ cm}^2$
 b) $A_b = 36\pi \text{ cm}^2$
 c) $A_T = 96\pi \text{ cm}^2$
 d) $h = 8 \text{ cm}$
 e) $V = 96\pi \text{ cm}^3$
 1171. a) $A_T = 108\pi \text{ dm}^2$
 b) $h = 6\sqrt{3} \text{ dm}$
 c) $V = 72\sqrt{3}\pi \text{ dm}^3$
 1172. $A_T = 144\pi \text{ m}^2$; $V = 128\pi \text{ m}^3$
 1173. $A_T = 24\pi \text{ cm}^2$; $V = 12\pi \text{ cm}^3$
 1174. $g = 4 \text{ dm}$
 1175. $V = 96\pi \text{ cm}^3$; $A_T = 96\pi \text{ cm}^2$
 1176. d 1177. a
 1178. a 1179. c
 1180. $V = 1720\pi \text{ cm}^3$
 1181. $V = 468\pi \text{ m}^3$
 1182. 1 050 litros 1183. c
 1184. b 1185. d
 1186. a) $h = 4 \text{ cm}$
 b) $V = 84\pi \text{ cm}^3$

1187. a
 1188. distância = $x = H \left(1 - \frac{\sqrt[3]{4}}{2} \right)$
 ou $x = H \left(1 - \sqrt[3]{\frac{1}{2}} \right)$
 1189. a
 1190. a) $A_e = 64\pi \text{ dm}^2$
 b) $V_e = \frac{256}{3}\pi \text{ dm}^3$
 1191. $A_e = 108 \text{ cm}^2$
 1192. $V_e = 32 \text{ cm}^3$
 1193. $V_e = \frac{32}{3}\pi \text{ cm}^3$
 1194. $V = 36\pi \text{ cm}^3$
 1195. b 1196. e
 1197. e 1198. d
 1199. b 1200. $V = 20$
 1201. $F = 10$
 1202. $V = 9$; $A = 16$
 1203. $F = 8$ 1204. $V = 60$
 1205. d 1206. c
 1207. d 1208. $S = 6480^\circ$
 1209. $V = 7$ 1210. $F = 6$
 $1211. 64\sqrt{3} \text{ cm}^2$
 $1212. 2a^2\sqrt{3}$ 1213. d
 1214. e 1215. d
 1216. e 1217. d
 1218. b 1219. c
 1220. c 1221. d
 1222. $V = 10$ 1223. e

Exercícios complementares

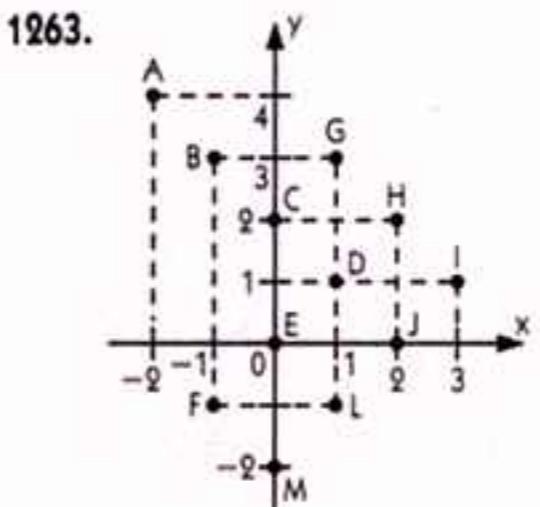
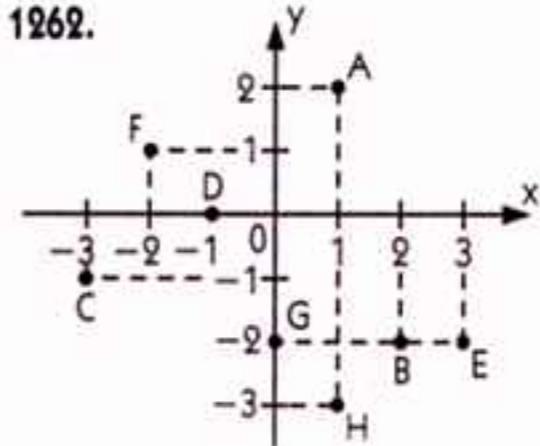
1224. $d = 5\sqrt{3} \text{ cm}$
 1225. $d = \sqrt{62} \text{ cm}$
 1226. $V = 64 \text{ m}^3$
 1227. $V = 250 \text{ dm}^3$
 1228. $V = 375\sqrt{3} \text{ m}^3$
 1229. $h = \frac{4\sqrt{3}}{3}a \text{ cm}$
 1230. a 1231. c
 1232. $A_T = 96 \text{ cm}^2$; $V = 48 \text{ cm}^3$
 1233. $V = 2 \text{ dm}^3$
 1234. $A_T = 256\sqrt{3} \text{ m}^2$
 1235. $A_T = 96 \text{ cm}^2$
 1236. c
 1237. b 1238. b
 1239. $y = \frac{2}{3}h$
 1240. 60
 1241. $A_T = 6\pi \text{ cm}^2$; $V = 2\pi \text{ cm}^3$
 1242. $A = 96\pi \text{ cm}^2$
 1243. 24 cm
 1244. A embalagem de raio r e altura h é mais vantajosa.

1245. b 1246. c
 1247. d
 1248. $A_T = 108\pi \text{ cm}^2$
 1249. $V = 27\pi \text{ dm}^3$
 1250. $V = 12\pi \text{ cm}^3$
 1251. c 1252. c
 1253. c 1254. c
 1255. b
 $1256. V = 36\pi \text{ cm}^3$
 $1257. V = 36\pi \text{ dm}^3$
 1258. $A_e = 100\pi m^2$; $V = \frac{500}{3}\pi m^3$
 1259. $h = 2(\sqrt{2} + 1) \text{ cm}$
 1260. $R = \sqrt{6} \text{ cm}$

GEOMETRIA ANALÍTICA

Exercícios propostos

1261. a) A(1,0) e) E(-2,-2)
 b) B(3,2) f) F(-3,-4)
 c) C(-1,2) g) G(2,-1)
 d) D(-4,1) h) H(0,-3)



- a) F, E, D, H, porque abscissa = ordenada
 b) E e L, pois $x = -y$
 c) C, E, M, pois abscissa é zero
 d) 2, sim
1264. a) $n = 2$ c) $n = 6$
 b) $n = 0$ d) $n = 7$
1265. a) $p = -2$ b) $p = -22$
 1266. a) 10 c) 10
 b) 13 d) 10
1267. a) $m = 10$ ou $m = -14$
 b) $m = 6$ ou $m = -4$
1268. a) 30 unidades de comprimento
 b) $20 + 2\sqrt{2}$ unidades de comprimento
1269. $P\left(\frac{9}{8}, 0\right)$

1270. O triângulo é isósceles em A.
 1271. b 1272. e
 1273. $k = 4$ 1274. $M = -\frac{14}{9}$
 1275. a) $x_M = -\frac{3}{2}$, $y_M = 1$
 b) $x_M = \frac{1}{2}$, $y_M = 3$
 c) $x_M = 3$, $y_M = 3$
 d) $x_M = -1$, $y_M = 0$
 e) $x_M = \frac{3}{2}$, $y_M = -\frac{1}{2}$
 f) $x_M = -5$, $y_M = 6$
1276. a) $d_{AM} = \frac{5\sqrt{2}}{2}$ unidades de comprimento
 b) $d_{AM} = \sqrt{26}$ unidades de comprimento
1277. e
1278. a) G(5, -2)
 b) G(-3, 4)
 c) G(3, -2)
1279. d 1280. e
 1281. a 1282. e
1283. a) D = 0 pertencem à mesma reta
 b) D ≠ 0 não pertencem à mesma reta
 c) D = 0 pertencem à mesma reta
 d) D ≠ 0 não pertencem à mesma reta
1284. a) $x_B = 4$ b) $x_B = 2$
 1285. $x_A = 2$ 1286. $y_B = 5$
 1287. $y_C = \frac{2}{3}$ 1288. P(6, 6)
1289. $k \neq 2$ 1290. b
 1291. a) $x + y - 2 = 0$
 b) $3x + y - 1 = 0$
 c) $x - 2y + 6 = 0$
 d) $4x + 3y - 7 = 0$
1292. a) $x - y = 0$
 b) $2x + y - 4 = 0$
 c) $x - y - 1 = 0$
1293. P ∈ r 1294. P ∉ s
 1295. $m = 1$ 1296. $n = 8$
 1297. $x = 2$ e $y = 1$ •
 1298. $x = 4$ e $y = -2$
 1299. b 1300. a
 1301. d 1302. c
1303. a) $\frac{x}{3} + \frac{y}{1} = 1$
 b) $\frac{x}{-3} + \frac{y}{1} = 1$
 c) $\frac{x}{4} + \frac{y}{-1} = 1$
1304. a) $\frac{x}{-9} + \frac{y}{-9} = 1$
 b) $\frac{x}{5} + \frac{y}{\frac{5}{2}} = 1$
 c) $\frac{x}{6} + \frac{y}{4} = 1$

1305. a) $\frac{x}{9} + \frac{y}{2} = 1$
 b) $\frac{x}{-3} + \frac{y}{-5} = 1$
 c) $\frac{x}{2} + \frac{y}{-4} = 1$

1306. d

1307. a) $m = 1$
 b) m não é definido
 c) $m = -\sqrt{3}$
 d) $m = -1$

1308. a) $m = \frac{1}{2}$ c) $m = 1$
 b) $m = 2$ d) $m = -1$

1309. a) $m = -\frac{2}{3}$ c) $m = 1$
 b) $m = \frac{5}{7}$ d) $m = \frac{2}{3}$

1310. a) $m = \frac{3}{2}$ c) $m = -\frac{3}{4}$
 b) $m = 1$ d) $m = -1$

1311. c

1312. a) $m = -\frac{2}{3}; n = \frac{1}{3}$
 b) $m = 1; n = 4$
 c) $m = -\frac{2}{5}; n = \frac{3}{5}$
 d) $m = -2; n = 5$

1313. a) $y = \frac{2}{3}x + \frac{1}{3}$
 $m = \frac{2}{3}; n = \frac{1}{3}$
 b) $y = -\frac{1}{3}x + 2$
 $m = -\frac{1}{3}; n = 2$

c) $y = 4x + 2; m = 4; n = 2$
 d) $y = \frac{2}{3}x + 2; m = \frac{2}{3}$
 $n = 2$
 e) $y = \frac{3}{4}x + \frac{3}{4}$
 $m = \frac{3}{4}; n = \frac{3}{4}$
 f) $y = x + 2; m = 1; n = 2$

g) $y = -x; m = -1; n = 0$

h) $y = -\frac{5}{7}x; m = -\frac{5}{7}$

$n = 0$

1314. a) $m = 1; n = 3; y = x + 3$
 b) $m = \sqrt{3}; n = -3$
 $y = \sqrt{3}x - 3$
 c) $m = -\sqrt{3}; n = -5$
 $y = -\sqrt{3}x - 5$
 d) $m = \frac{\sqrt{3}}{3}; n = 0$
 $y = \frac{\sqrt{3}}{3}x$

1315. a) $m = 4$ P(0, -3)
 b) $m = -\frac{4}{5}$ P(0, -3)
 c) $m = 2$ P(0, 10)
 d) $m = \frac{3}{2}$ P(0, -3)

1316. b

1317. b
 1318. a) $2x - y = 0$
 b) $3x + y - 15 = 0$
 c) $x + y + 2 = 0$
 d) $x - 2y + 10 = 0$
 e) $2x - 6y + 17 = 0$
 f) $25x + 5y - 26 = 0$

1319. a) $-x + y + 1 = 0$
 b) $x + y - 3 = 0$
 c) $-\sqrt{3}x + 3y + 12 = 0$
 d) $\sqrt{3}x + y - 1 = 0$
 e) $\sqrt{3}x + 3y - 3 + 4\sqrt{3} = 0$

1320. a 1321. a 1322. d

1323. a) $x + 2y - 2 = 0$
 b) $3x + 2y - 6 = 0$

1324. a) $3x + y - 5 = 0$
 b) $y = -3x + 5$
 c) $m = -3$

1325. b

1326. a) paralelas distintas
 b) paralelas distintas
 c) coincidentes
 d) paralelas distintas

1327. a) $2x - y - 5 = 0$
 b) $5x + 4y + 22 = 0$
 c) $2x - y - 6 = 0$
 d) $x - 3y - 10 = 0$

1328. k = -3

1329. e 1330. e

1331. e 1332. e
 1333. a) são paralelas e distintas
 b) $m = 4$

1334. a) concorrentes e perpendiculares
 b) concorrentes e perpendiculares
 c) concorrentes não-perpendiculares
 d) concorrentes e perpendiculares

1335. a) $x + y - 3 = 0$
 b) $3x + 4y + 2 = 0$
 c) $x + 7y + 19 = 0$
 d) $4x + 3y + 2 = 0$

1336. k = 3 1337. d

1338. e 1339. a

1340. e

1341. a) $x - 2y + 5 = 0$
 b) $2x + y - 3 = 0$

1342. b 1343. d 1344. a

1345. $m_1 = \frac{9}{5}$ e $m_2 = -\frac{8}{3}$, logo
 re s não são ortogonais

1346. b 1347. e

1348. $\theta = 60^\circ$ 1349. $\theta = 45^\circ$

1350. $x + 7y - 27 = 0$ ou
 $7x - y - 39 = 0$

1351. e 1352. d

1353. a) $d = 2$

b) $d = \frac{11\sqrt{13}}{13}$

c) $d = \frac{7\sqrt{29}}{29}$

d) $d = 0, P \in r$

1354. a) $h = \frac{93}{5}$ b) $\frac{3\sqrt{10}}{2}$

1355. a) $d = \frac{19\sqrt{13}}{26}$

b) $d = \frac{5\sqrt{2}}{2}$

1356. e 1357. a

1358. a 1359. b

1360. a 1361. a

1362. a) área = 0
 (A, B e C estão alinhados)

b) área = 8
 (unidades de área)

c) área = $\frac{3}{2} = 1,5$
 (unidades de área)

d) área = $\frac{15}{2} = 7,5$
 (unidades de área)

1363. $y_A = 12$ ou $y_A = -20$

1364. $x_B = -12$ ou $x_B = 52$

1365. e 1366. c

1367. b 1368. c

1369. b 1370. a

1371. a) $x + y - 3 = 0$
 b) $m = -2$

1372. a) $(x - 3)^2 + (y - 3)^2 = 9$
 b) $(x - 1)^2 + (y - 1)^2 = 1$

c) $(x + 3)^2 + (y + 2)^2 = 1$
 d) $(x - 1)^2 + (y - 2)^2 = 9$

e) $x^2 + y^2 = 9$

f) $\left(x - \frac{1}{3}\right)^2 + \left(y - \frac{2}{3}\right)^2 = 1$

1373. a) $r = 5; C(-2, -2)$

b) $r = 3; C(3, -1)$

c) $r = 3; C(1, -2)$

d) $r = 1; C(-3, -2)$

e) $r = 5\sqrt{3}; C(2, -2)$

f) $r = 2; C(-1, 2)$

g) $r = 4; C(0, 0)$

h) $r = 5; C(0, 0)$

1374. P(0, 2)

1375. P(1, 0); P(-5, 0)

1376. e 1377. e

1378. a 1379. a

1380. (λ): $(x - 2)^2 + (y - 1)^2 = 1$

1381. e

1382. $(x - 1)^2 + y^2 = 4$

1383. a) $r < 0$; a equação não
 representa uma circunferência

b) $r = \frac{\sqrt{6}}{2}; C\left(-1, \frac{1}{2}\right)$

c) $r = \sqrt{3}; C(0, 0)$

d) $r = 2; C(0, -2)$

e) $r = 0$, a equação não
 representa uma circunferência

f) $r = 3; C(3, 3)$

1384. a) sim; $r = \sqrt{2}; C(1, 1)$

b) sim; $r = 2\sqrt{2}; C(4, 4)$

c) não

d) sim; $r = \sqrt{10}; C(4, 3)$

1385. a

1386. c

1387. e

1388. a

1389. e

1390. d

1391. d

1392. a

1393. a) $P \in \lambda$

b) P é externo a λ

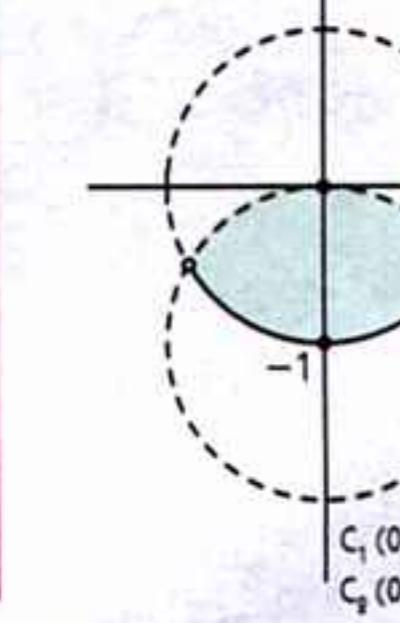
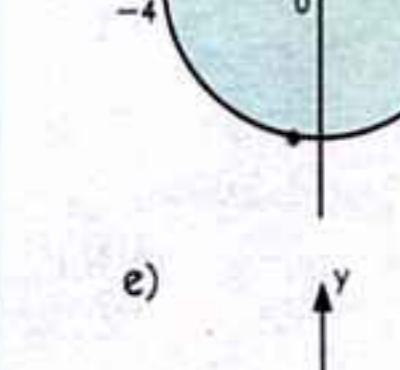
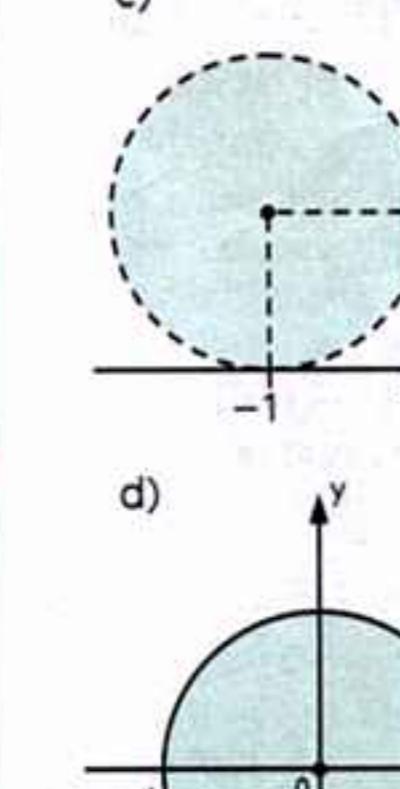
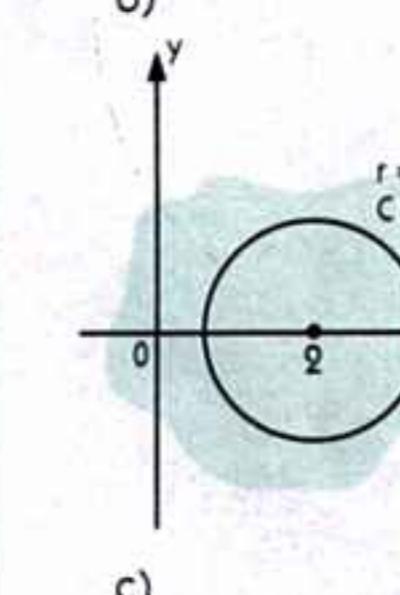
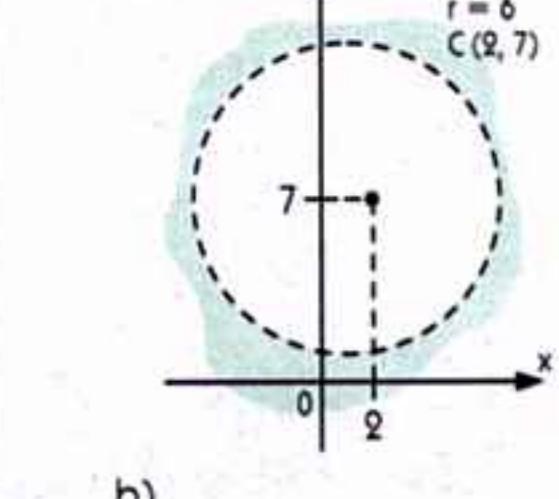
c) P é interno a λ

d) P é interno a λ

e) P é externo a λ

f) $P \in \lambda$

1394. a)



$C_1(0, -1); r_1 = 1$
 $C_2(0, 0); r_2 = 1$

1395. b 1396. b

1397. b 1398. c

- a) s é tangente a λ
b) s é exterior a λ
c) s é tangente a λ
d) s é secante a λ
e) s é secante a λ
f) s é exterior a λ

1400. b 1401. a

1402. b = $\pm \sqrt{5}$ 1403. 3

1404. c 1405. d

1406. a 1407. d

1408. b 1409. c

1410. $(2 + 3\sqrt{5}, -1 + \sqrt{5})$ e
 $(2 - 3\sqrt{5}, -1 - \sqrt{5})$

1411. a

Exercícios complementares

1412. $d_{AB} = 10$

1413. $2p = 2\sqrt{2} + \sqrt{13} + \sqrt{17}$

1414. $d_{AM} = 3\sqrt{10}$; M(6, 6)

1415. D ≠ 0 ⇒ os pontos A, B e C são vértices de um triângulo

1416. $y_A = 1$

1417. $2x - 3y - 13 = 0$

1418. $m = -\frac{3}{4}$

1419. $y = -\frac{4}{3}x + 4$

1420. perpendiculares

1421. $\frac{3}{2}x - y + 8 = 0$ ou

$3x - 2y + 16 = 0$

1422. A intersecção é o ponto P(1, 1).

1423. a) Q = (7, 7)
b) V ≈ 31,4 km/h

1424. k = 5, k = -5

1425. e 1426. d

1427. 2 (unidade de área)

1428. e 1429. c 1430. b

1431. c 1432. a 1433. e

1434. c 1435. d 1436. d

1437. C(4, 5); r = 5

1438. $\lambda \cap \overleftrightarrow{Oy} = \emptyset$

1439. d 1440. P ∈ λ

1441. $x^2 - 6x + y^2 - 8y = 0$

1442. C($\frac{3}{2}, -\frac{3}{2}$) e r = $\frac{5}{2}$

1443. $4x^2 + 4y^2 - 25y = 0$

1444. b 1445. c 1446. a

1447. a 1448. a 1449. d

1450. 3 1451. c

NÚMEROS COMPLEXOS

Exercícios propostos

1452. a) $a = -4$; $b = 5$

b) $a = \frac{1}{2}$; $b = 2$

1453. a) $(\frac{65}{8}, -\frac{6}{10})$

b) $(3\sqrt{2}, 2\sqrt{3})$

c) $(\frac{65}{8}, -\frac{6}{10})$

d) $(\sqrt{5}, -2)$

e) $(-5, 10)$

f) $(-5, 10)$

g) $(56, 0)$

h) $(-1, 0)$

1454. a = 2; b = 6

1455. x = 1; y = 2

1456. a) 3 b) $\frac{1}{2}$

1457. -5

1458. $x \neq -1$

1459. m = 0; n = 2

1460. x = 2; y = 4

1461. 2 1462. 1 1463. b

1464. a) 1 d) i

b) -1 e) 0

c) -i f) $\frac{1}{8} + \frac{1}{8}i$

1465. a) -5 b) -i

1466. a

1467. são iguais

1468. zero

1469. e 1470. a

1471. b

1472. a) $2 - 5i$ g) $19 + 2i$

b) $6 + 3i$ h) $8 - 3i$

c) $19 + 3i$ i) $\frac{5}{16}$

d) 37 j) 6

e) 13 l) $a^2 + b^2$

f) $-60 + 10i$

1473. x = 6; y = 2

1474. m = 1 e n = 1 ou

m = -1 e n = -1

1475. a) z = 0, 3 - i

b) z = -12i

c) z = -8

d) z = -4i + 7

1477. z = $1 + 2i$ ou z = $-1 + 2i$

1479. d

1480. z = $-3 + 5i$ ou z = $3 + 5i$

1481. a) $\frac{7}{10} - \frac{1}{10}i$

b) $\frac{1}{2}$

c) $\frac{7}{5} + \frac{4}{5}i$

d) $\frac{7}{25} + \frac{24}{25}i$

e) $\frac{1}{5} - \frac{3}{5}i$

f) 4i

1482. a) $\frac{3}{5} + \frac{1}{5}i$

b) $-\frac{17}{25} - \frac{31}{25}i$

1483. $-1 - i$ 1484. 0

1485. -2 1486. d

1487. 4 1488. 3

1489. $-1 < x < 0$

1490. d 1491. c

1492. c 1493. a

1494. a 1495. c

1496. a) $p = 4\sqrt{2}$, $\theta = \frac{\pi}{4}$ rad

b) $p = 2$, $\theta = \frac{4\pi}{3}$ rad

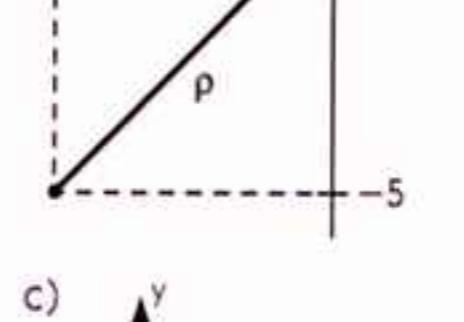
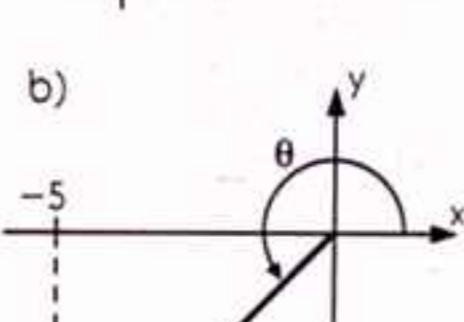
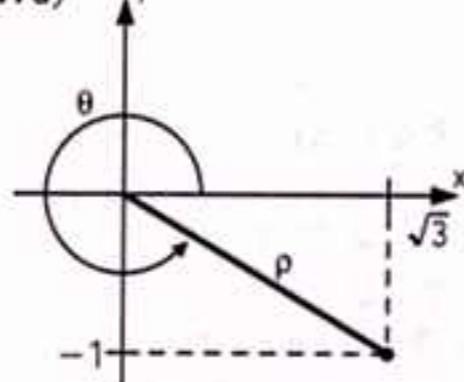
c) $p = 2$, $\theta = \frac{7\pi}{6}$ rad

d) $p = \sqrt{2}$, $\theta = \frac{3\pi}{4}$ rad

e) $p = 1$, $\theta = \frac{\pi}{2}$ rad

f) $p = 3,5$; $\theta = 0$ rad

1497. a)



1498. b 1499. a

1500. b 1501. c

1503. a) $z = 2 \cdot \left(\cos \frac{\pi}{6} + i \sin \frac{\pi}{6} \right)$

b) $z = 3\sqrt{2} \cdot \left(\cos \frac{\pi}{4} + i \sin \frac{\pi}{4} \right)$

c) $z = 2\sqrt{2} \cdot \left(\cos \frac{7\pi}{4} + i \sin \frac{7\pi}{4} \right)$

d) $z = 2 \cdot \left(\cos \frac{11\pi}{6} + i \sin \frac{11\pi}{6} \right)$

1504. a) $z = \sqrt{3} + i$

b) $z = 2\sqrt{2} + 2\sqrt{2}i$

c) $z = -3\sqrt{2} - 3\sqrt{2}i$

d) $z = 3i$

1505. a

1506. d

1507. a) 9,6i

b) $-9 + 3\sqrt{3}i$

c) $-2 + 2i$

1508. c

1509. a) -8

b) -64

c) -64

d) $-128 - 128\sqrt{3}i$

e) -16

1510. a

1511. e

1512. c

1513. a

Exercícios complementares

1514. x = -5 e y = -2

1515. b 1516. 2

1517. e 1518. 1

1519. a) 1 c) 0

b) 1 d) 2i

1541. $a = 3$ ou $a = -3$

1542. a) -2 c) 122
b) -23 d) -1

1543. $n = 5$

1544. $m = 3$; $n = 4$

1545. $a = 1$; $b = 2$

1546. a) se $a \neq 0$, o polinômio é de 4^{a} grau

b) se $a \neq 2 \Rightarrow 2^{\text{a}}$ grau
 $a = 2 \Rightarrow 1^{\text{a}}$ grau

c) $a \neq 1$ e $a \neq 3$ (3^{a} grau)
se $a = 3 \Rightarrow (2^{\text{a}}$ grau)

se $a = 1 \Rightarrow (1^{\text{a}}$ grau)

1547. c 1548. c 1549. e

1550. $a = 8$; $b = 3$; $c = 0$

1551. $m = -\frac{2}{3}$; $n = \frac{1}{2}$; $t = 0$

1552. $\exists k \in \mathbb{R} \mid p(x) \equiv 0$

1553. $a = -\frac{5}{2}$; $b = \frac{7}{3}$

1554. $a = -3$; $b = 9$

1555. $m = 1$; $t = -8$

1556. $a = b = 2$; $c = -2$; $d = 0$

1557. d

1558. a) $m = 4$; $n = -\frac{7}{2}$
b) $m = 4$; $n = -4$

1559. a) $6x^3 + 5x^2 - 6x + 16$

b) $4x^3 + x^2 - 4x$

c) $-4x^3 - x^2 + 4x$

d) $6x^3 + 5x^2 - 6x + 16$

1560. a) 3 b) 4 c) 4

1561. $m = -2$; $n = \frac{3}{5}$ e $p = 6$

1562. a) $x^6 - 2x^4 + x^2$

b) $3x^7 + 6x^6 - 4x^5 - 4x^4 - 3x^3 - 2x^2 + 4x$

1563. a) 4 b) 6 c) 6

1564. a) $Q(x) = x - 4$; $R(x) = 0$

b) $Q(x) = x^2 + 3x - 5$
 $R(x) = 0$

c) $Q(x) = x + 3$; $R(x) = 0$

d) $Q(x) = 7x + 21$
 $R(x) = 55$

e) $Q(x) = x^2 - 6$
 $R(x) = x + 6$

f) $Q(x) = 2x + 5$; $R(x) = 1$

1565. $A(x) = x^3 - 4x^2 + 6x - 1$

1566. $D(x) = 2x^2 - 5x - 12$

1567. $m = -24$

1568. $k = 2$ 1569. e

1570. a) $R(x) = 20$

b) $R(x) = 0$

c) $R(x) = -62$

d) $R(x) = -2$

1571. $m = -\frac{20}{3}$

1572. $k = -\frac{39}{8}$

1573. $y = \frac{7}{4}$

1574. $p = -\frac{85}{3}$

1575. $m = -2$; $n = 5$

1576. $a = -3$

1577. $p(-1) = 0$, logo $p(x)$ é divisível por $(x + 1)$

1578. a) $Q(x) = x - 2$; $R(x) = 2$

b) $Q(x) = x^2 + 3x + 2$
 $R(x) = 5$

c) $Q(x) = 4x^2 - 10x + 23$
 $R(x) = -47$

d) $Q(x) = x^3 + 5x^2 + 15x + 46$
 $R(x) = 132$

e) $Q(x) = 4x^2 + 16x + 61$
 $R(x) = 248$

1579. a) $Q(x) = x^2 - \frac{3}{2}x - \frac{1}{4}$

$R(x) = -\frac{13}{4}$

b) $Q(x) = -3x^2 + \frac{5}{2}x - \frac{7}{4}$

$R(x) = -\frac{9}{4}$

c) $Q(x) = \frac{1}{2}x^3 + \frac{7}{4}x^2 + \frac{17}{8}x + \frac{51}{16}$

$R(x) = \frac{169}{16}$

d) $Q(x) = \frac{1}{2}x^2 - \frac{3}{4}x + \frac{21}{8}$

$R(x) = -\frac{71}{8}$

1580. $R(x) = 26$

1581. $Q(x) = x^3 - 2x^2 + 10x - 19$

1582. coeficiente de $x = 14$

1583. $k = -1$ ou $k = \frac{4}{3}$

1584. $R(x) = \frac{9}{5}x + \frac{19}{5}$

1585. e 1586. d

1587. e 1588. b

1589. d 1590. a

1591. e

1592. a) quociente: $2x + 6$
resto: $Ax + (3B - 54)$

b) $A = 0$ e $B = 18$
resto = 0

1593. 3 1594. d 1595. b

1596. $P(x) = (x + 1) \cdot (x - 5) \cdot (x - 3)$

1597. $P(x) = 3 \cdot (x - 2) \cdot (x + 1) \cdot (x + 4)$

1598. S = $\{-3, 1, 2\}$

1599. S = $\{-3, -1, 1, 2\}$

1600. $P(x) = 2x^4 - 5x^3 - 8x^2 + 17x - 6$

1601. $k = 60$

1602. $b = 1$ e $a = 5$

1603. $V = \left\{ \frac{1}{3}, \frac{2}{3}, 3 \right\}$

1604. a 1605. d

1606. S = $\{-2, 1 + i, 1 - i\}$

1607. a) 2 d) $\frac{3}{4}$

b) 3 e) -2

c) 4

1608. 4, 1 e -2

1609. a 1610. c

1611. a 1612. d

1613. e 1614. 1

1615. a) 8

b) $V = \{-5, 0, 1\}$

1616. V = $\{-1, 5\}$

1617. V = $\{-1, 3\}$

1618. a = 1; b = -12

1619. m = -6; n = 12

1620. a = -2; b = -7; c = -3

1621. 2

1622. m = -3

1623. V = $\{-i, i, -2\}$

1624. V = $\{-i, i, -2\}$

1625. V = $\{-i, i, -3, 2\}$

1626. m = 6 e n = 25

1627. p = -1 e q = 2

1628. c 1629. e

1630. p + q = 11 1631. d

1632. a) $\frac{1}{3}$

b) $\frac{1}{2}$

c) $V = \left\{ -\frac{1}{3}, 0, 1, 2 \right\}$

1633. a) V = $\{-3, 1, 2\}$

b) $V = \left\{ -2, -\frac{1}{2}, 1 \right\}$

1634. V = $\{-\sqrt{3}, \sqrt{3}, 2\}$

1635. A equação não admite raízes inteiros.

1636. A equação não admite raízes inteiros.

Exercícios complementares

1637. k = 5 ou k = -5

1638. k = $-\frac{4}{3}$

1639. a = 1, b = 2

1640. $2m(m^2 + 2m + 3)$

1641. a) $\frac{3}{2}$, b = 4, c = $\frac{1}{7}$

1642. a = 4, b = 2, c = -2

1643. m = -5, n = $-\frac{2}{5}$

1644. a

1645. p = 4; q = 9

1646. d

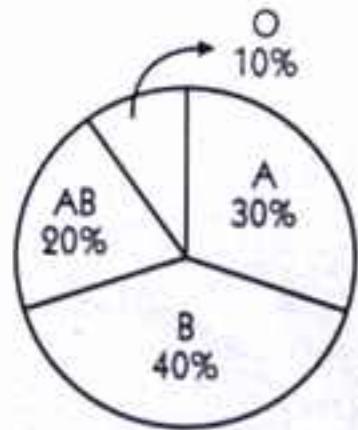
1647. m = 10

1648. k = -8

1649. Q(x) = $x^2 + 2x - 1$ R(x) = 7

1650. e

1651. P(x) = $3x^4 - 4x^3 + 5x^2 + 74x + 88$

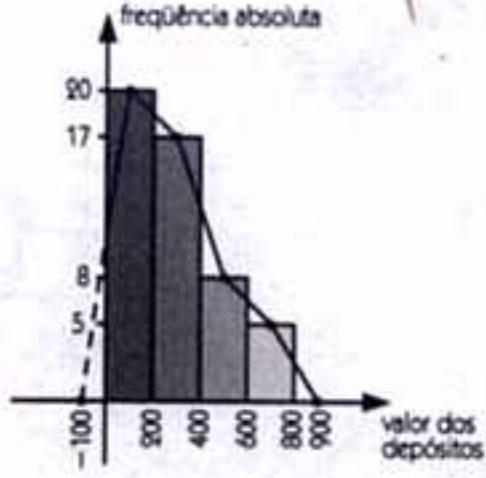


1669. b

1670. aproximadamente
 $1,65 \cdot 10^{-4}$ mg de chumbo

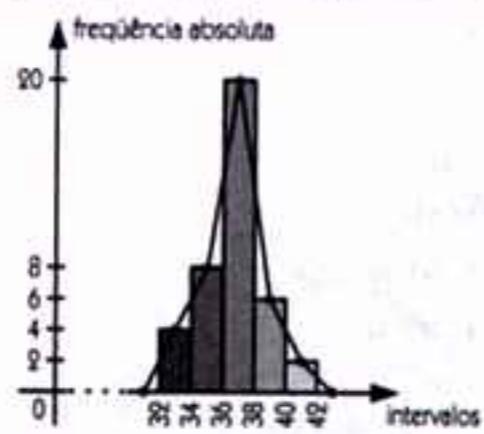
1671.

Intervalos	Freqüência absoluta	Freqüência relativa
0 — 200	20	$\frac{20}{50} \cdot 100\% = 40\%$
200 — 400	17	$\frac{17}{50} \cdot 100\% = 34\%$
400 — 600	8	$\frac{8}{50} \cdot 100\% = 16\%$
600 — 800	5	$\frac{5}{50} \cdot 100\% = 10\%$
Total	50	100%



1672.

Intervalos	Freqüência absoluta	Freqüência relativa
32 — 34	4	10%
34 — 36	8	20%
36 — 38	20	50%
38 — 40	6	15%
40 — 42	2	5%
Total	40	100%



1673. e

1674. média aritmética $\approx 1,78$
 mediana = 1,8;
 moda = zero1675. média aritmética $\approx 1,36$
 mediana = 1,15;
 moda = 1,12

1676. e

1677. média aritmética = 5

1678. Mo = 15, x = 16

1679. a

1680. 40 homens e 80 mulheres

1681. c

1682. média aritmética = 50
 desvio médio = 20
 variância = 500
 desvio padrão $\approx 22,3$ 1683. média = 160
 desvio médio = 64
 variância = 5600
 desvio padrão $\approx 74,8$ 1684. a) idade média = 19,1
 desvio médio = 3,68
 variância $\approx 19,59$
 desvio padrão $\approx 4,4$

MATEMÁTICA FINANCEIRA

Exercícios propostos

1685. a) 0,05 c) 0,079
 b) 0,641686. a) 36% c) 0,9%
 b) 4%1687. a) 15,4 c) R\$ 4,55
 b) 1,5 d) 2765,07 g1688. a) 1,2% c) 14,4%
 b) 4,8%1689. d 1690. b
 1691. b 1692. b1693. 50% 1694. R\$ 960,00
 1695. d 1696. d

1697. d

1698. e

1699. c

1700. $i_D \approx 33,3\%$

1701. R\$ 16 800,00

1702. $i_D = 20\%$ 1703. $i_D = 25\%$

1704. e 1705. e

1706. e 1707. e

1708. $P_n = R\$ 36,06$ 1709. $P_n = R\$ 0,70$

1710. d 1711. não

1712. b 1713. d

1714. $P_n = R\$ 728,19$ 1715. $P_n = R\$ 10 616,83$

1716. a 1717. d

Exercícios complementares

1. a) 6 c) 5 e 8
 b) 7,52. a) A maior parte dos alunos é composta de meninos.
 b) 62,5%

3. e 4. c

5. d 6. c

7. $y = R\$ 273,24$

8. b