

Soluciones de los ejercicios impares del desarrollo de la competencia de la unidad 1

1. a) 2, c) 0, e) $\frac{-8}{2} = -4$

3. a) 2.157893..., c) $\sqrt{5}$, d) e , e) $\ln(2)$

5. a) 2

7. $0.025 = \frac{25}{1000}$

9. $-4.35 = -\frac{87}{20}$

11. $7.658 = \frac{3829}{500}$

13. $1.006161... = \frac{9961}{9900}$

15. $0.123980980... = \frac{123857}{999000}$

17. $-0.3519\overline{6} = -\frac{34845}{99000}$

19. $121.\overline{349} = \frac{121228}{999}$

21. $-11.3519\overline{6} = -\frac{74923}{6600}$

23. $0.21333... = \frac{96}{450}$

25. $\text{sen}\left(\frac{\pi}{3}\right) \approx \frac{34641}{40000}$

27. $5\ln(9) \approx \frac{5493061}{500000}$

29. $\sqrt[3]{18} \approx \frac{2620741}{1000000}$

31. $\tan^{-1}(3) \approx \frac{249809}{200000}$

33. Racional

35. Irracional

37. Racional

39. Racional

41. Irracional

43. Irracional

45. Irracional

47. V

49. V

51. F

53. V

55. V

57. F

59. V

61. F

63. F

65. <

67. =

69. $> y < 0 < y >$

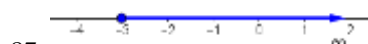
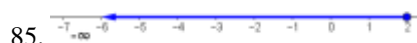
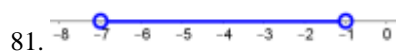
71. >

73. $\text{Ínf}(B) = 0, \text{Sup}(B) = \frac{1}{4}$

75. $\text{Ínf}(A) = \frac{1}{2}, \text{Sup}(A) = 1$

77. $\text{Ínf}(B) = 0, \text{Sup}(B) = \cancel{A}$

79. $\text{Ínf}(A) = 0, \text{Sup}(B) = \cancel{A}$



87.

89. $S = \mathbb{R}$

91. $S = (-4, 4)$

93. $S = (-2, 5)$

95. $S = (-4, 11] \cup [21, \infty)$

97. $S = [-7, \infty)$

99. $S = [-5, 4)$

101. F

103. F

105. V

107. <

109. <

111. >

113. No cumple

115. No cumple

117. No cumple

119. Si cumple

121. a) $S = [0, 2]$ y b) $s = \left(-\infty, \frac{1}{2}\right]$

123. a) $S = (-\infty, -3]$ y b) $S = [0, \infty)$

125. a) $S = \left\{\frac{3}{2}\right\}$ y b) $S = \mathbb{R} - \left\{\frac{3}{2}\right\}$

127. $S = (1, \infty)$

129. $S = \left[\frac{3}{2}, \infty\right)$

131. $S = \left(-\infty, \frac{1}{2}\right]$

133. $S = \left(\infty, -\frac{2}{3}\right)$

135. $S = \left(\infty, -\frac{20}{3}\right]$

137. $S = \left(-\infty, -\frac{130}{11}\right]$
139. $S = \mathbb{R}$
141. $S = \left[-\frac{13}{3}, \frac{5}{3}\right]$
143. $S = (-2, 2)$
145. $S = (-1, 10)$
147. $S = (-\infty, -6] \cup [-1, \infty)$
149. $S = \left[\frac{-\sqrt{33}+5}{2}, \frac{\sqrt{33}+5}{2}\right]$
151. $S = \left(-\frac{2}{3}, 1\right)$
153. $S = \{ \}$
155. $S = \left(1, \sqrt{\frac{5}{3}}\right]$
157. $S = \left(\frac{11}{3}, 4\right)$
159. $S = (-\infty, 3)$
161. $S = \left(-\infty, \frac{1}{2}\right) \cup \left(\frac{2}{3}, \infty\right)$
163. $S = \left(\frac{-\sqrt{17}+3}{4}, 1\right) \cup \left(\frac{\sqrt{17}+3}{4}, \infty\right)$
165. $S = \left(-\infty, \frac{3}{2}\right) \cup [6, \infty)$
167. $S = \left(-2, \frac{15}{17}\right) \cup (5, \infty)$
169. $S = [-7, 3]$
171. $S = (-\infty, -15] \cup [5, \infty)$
173. $S = \left(-4, -\frac{4}{3}\right)$
175. $S = \left[-\frac{3}{4}, \frac{5}{2}\right]$
177. $S = [-6, -4) \cup \left(-4, -\frac{14}{5}\right]$
179. $S = (-\infty, -\frac{7}{4}) \cup (\frac{7}{6}, \infty)$
181. $S = (-4, 0)$
183. $S = (-\infty, -5) \cup \left(\frac{8}{3}, 3\right)$
185. $S = (-\infty, -3) \cup (-2, 2) \cup (3, \infty)$
187. $S = (-\infty, -2.88) \cup (0.47, 4.41)$
189. $S = (-3, 0) \cup (3, \infty)$
191. Jorge es el mayor
193. $S = (14, 15] = (2:00 \text{ pm}, 3:00 \text{ pm}]$
195. $100 < L < 110$
197. 4 pesos
199. $\frac{2}{5}$ del pastel.
201. menos de 80 kg
- 203.a) $F_T = F - F_f$ b)
- $F_T = 11N - 21N = -10N$
205. 12916 km como máximo.
207. $t = [0, 2.43] \text{ s}$
209. $d = [0.185, 0.189] \text{ in}$

Soluciones a la evaluación de la competencia de la unidad 1

1. F
2. F
3. F
4. V
5. V
6. F
7. F
8. V
9. V
10. V
11. F
12. V
13. V
14. V
15. F
16. $\text{Ínf}(A) = \cancel{a}, \text{Sup}(A) = \cancel{a}$
17. $\text{Máx}(B) = 2 \quad \text{Mín}(B) = \frac{11}{100}$
18. $(-4, 15]$
19. $[6, 13)$
20. $x \in (-\infty, \infty)$
21. $x \in (-\infty, 0)$
22. Propiedad distributiva
23. $10 < x \leq 11$
24. $\left\{-\frac{2}{3}, -\frac{1}{5}, \ln 1, \frac{3}{6}, \sqrt{2}, e\right\}$
25. $S = \emptyset$
26. $S = \mathbb{R} - \left\{-\frac{b}{a}\right\}$
27. $S = \mathbb{R}$

28. $x \leq \frac{13}{32}$

29. $S = \emptyset$

30. $(-\infty, -3] \cup [3, \infty)$

31. $S = \{ \}$

32. $S = \mathbb{R}$

33. $S = (-3, 2)$

34. $S = (-\sqrt{7}, \sqrt{7})$

35. $S = (-\infty, -1) \cup \left(0, \frac{3}{2}\right)$

36. $\left(-\infty, \frac{-\sqrt{17}+7}{2}\right) \cup \left(\frac{\sqrt{17}+7}{2}, \infty\right)$

37. $S = (\infty, -3) \cup \left(-\frac{7}{5}, -1\right)$

38. $S = \left(-\infty, -\frac{1}{6}\right) \cup (2, 5)$

39. $S = [-3, 3]$

40. $S = (-\infty, -1) \cup \left(-\frac{1}{5}, \infty\right)$

41. $S = \left(-\frac{1}{6}, 0\right) \cup \left(0, \frac{1}{4}\right)$

42. $S = (-\infty, 0) \cup (0, 1]$

43. $S = (-\infty, 2)$

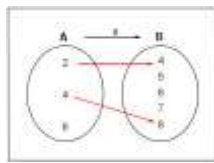
44. a) $t = [3, 10]$ y b) $t = [3, 5]$

45. $x = \left[240, \frac{2920}{7}\right]$

Soluciones de los ejercicios impares del desarrollo de la competencia de la unidad 2

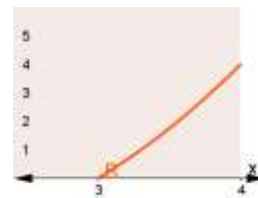
1. a) $R = \{(2, 4), (4, 8)\}$

b) $R = \{(x, y) \in A \times B \mid y = 2x\}$



c)

d) $D_R = \{2, 4, 6\}$ y $R_R = \{4, 8\}$

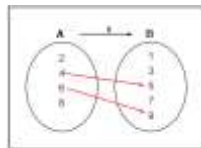


c) -1

d) $D_R = [3, 4]$ y $R_R = [0, 4]$

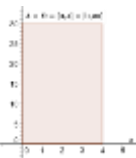
3. a) $R = \{(4, 5), (6, 9)\}$

b) $R = \{(x, y) \in A \times B \mid y = 2x - 3\}$



c)

d) $D_R = \{2, 4, 6, 8\}$ y $R_R = \{5, 9\}$



5. a)

b) $R = \{(x, y) \in A \times B \mid y = x^2 - 3x\}$

7. La relación es una función.

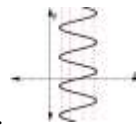
9. La relación no es función

11. La relación no es función

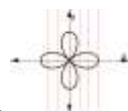
13. La relación es una función con $y = -3x - 5$

15. La relación no es función

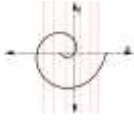
17. La relación es una función.



19. No es función



21. No es función



23. No es función

25. a) -3, b) -3 y c) $a^2 + 3a - 1$

27. a) No definido, b) $\frac{5}{3}$ y c) $\frac{b}{b-2}$

29. a) 2, b) $\sqrt{8}$ y c) $\sqrt{\frac{24}{7}}$

31. a) 5, b) 25, c) 2 y d) -3

33. a) 6, b) 0, c) -1 y d) 0.5

35. $x=1$ y $x=2$

37. $x=-4$

39. $-\frac{2}{3}$

41. $\frac{833}{2544}$

43. a) $\frac{\sqrt{5}+3}{9}$ y b) 4

45. $\frac{-1}{x(x+h)}$

47. $\frac{\sqrt{h+x} - \sqrt{x}}{h}$

49. $D_f = [-5, \infty)$, $R_f = [0, \infty)$

51. $D_f = (-\infty, -\sqrt{6}] \cup [\sqrt{6}, \infty)$, $R_f = [0, \infty)$

53. $D_f = (-\infty, 2] \cup [3, \infty)$, $R_f = [0, \infty)$

55. $D_f = (-\infty, 2) \cup (2, \infty)$, $R_f = (-\infty, 1) \cup (1, \infty)$

57. $D_f = (-\infty, 3) \cup (3, \infty)$, $R_f = (-\infty, 0) \cup (0, \infty)$

59. $D_f = (-\infty, -2) \cup (-2, 1) \cup (1, \infty)$,
 $R_f = (-\infty, 0) \cup (0, \infty)$

97. $f(x) = x^3$, $t(x) = 2 - x^3$: reflexión sobre eje x y desplazamiento vertical en dos unidades.

61. $D_f = (-\infty, 8)$, $R_f = (-\infty, \infty)$

63. $D_f = (-\frac{3}{2}, \frac{3}{2})$, $R_f = [0, \infty)$

65. $D_f = (-\frac{9}{5}, \infty)$, $R_f = (-\infty, \infty)$

67. $D_f = (-\infty, -1) \cup (0, \infty)$, $R_f = (-\infty, 0) \cup (0, \infty)$

69. $D_f = [\frac{1}{2}, \frac{3}{4}] \cup (\frac{3}{4}, \infty)$,
 $R_f = (-\infty, 0) \cup (0, \infty)$

71. $D_f = (-\frac{\sqrt{5}}{2}, \frac{\sqrt{5}}{2})$, $R_f = (-\infty, \ln(5)]$

73. $D_f = (-\infty, 0) \cup (0, \infty)$, $R_f = (-\infty, -2] \cup [2, \infty)$

75. $D_f = (-\frac{3}{2}, 2]$, $R_f = [0, \infty)$

77. a) Impar y b) Intersección eje x y eje y en (0,0).

79. a) Impar y b) Intersección eje x y eje y en (0,0).

81. a) Par y b) Intersección eje x y eje y en (0,0).

83. a) Sin simetría, b) Eje x: (-1,0) y (0,0).

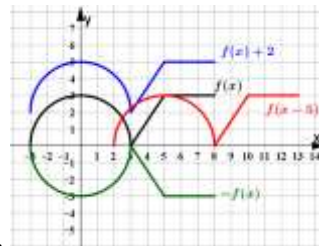
85. a) Impar, b) Eje x:
 $(-\frac{3}{2}, 0), (-1, 0), (0, 0), (1, 0)$ y $(\frac{3}{2}, 0)$

87. a) Par, b) Eje x: $(-\sqrt{\frac{1}{2}}, 0), (0, 0)$ y $(\sqrt{\frac{1}{2}}, 0)$

89. a) Impar, b) Intersección eje x y eje y en (0,0)

91. Función periódica T=3

93. Función periódica T=4



95.

99. $f(x) = \frac{1}{x^2}$, $t(x) = \frac{-6}{(x-2)^2}$: reflexión sobre eje x, desplazamiento horizontal a la derecha en dos unidades y alargamiento vertical por un factor de seis.

101. $f(x) = e^x$, $t(x) = e^{-3x+4} - 1$: reflexión sobre eje x, compresión horizontal por un factor de tres, desplazamiento horizontal a la izquierda en cuatro unidades, y desplazamiento vertical en una unidad hacia abajo.

103. $f(x) = x^2$, $t(x) = 5(x-3)^2$: alargamiento vertical por un factor de cinco y desplazamiento a la derecha en tres unidades.

105. $f(x) = \ln(x)$, $t(x) = -\frac{1}{6}\ln(x-2)$: compresión vertical por un factor de seis, reflexión sobre eje x y desplazamiento horizontal a la derecha en dos unidades.

107. $f(x) = x^5$, $t(x) = 6x^5 - 1$: alargamiento vertical por un factor de seis y desplazamiento vertical en dos unidades.

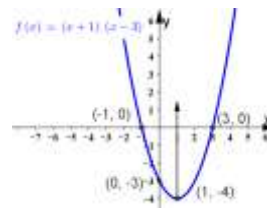
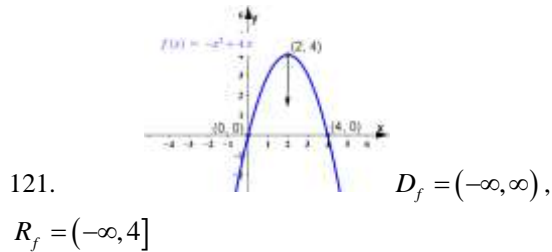
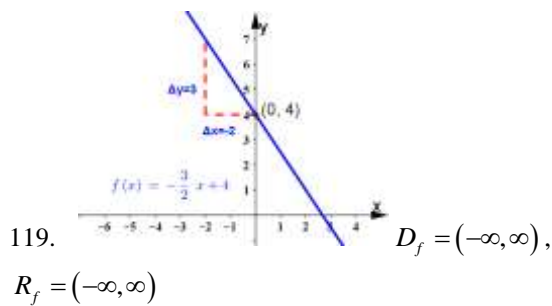
109. $t(x) = \frac{e^{\frac{x}{5}}}{2}$

111. Ninguna

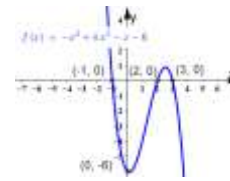
113. Biyectiva.

115. Inyectiva

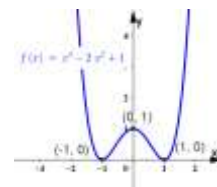
117. Biyectiva



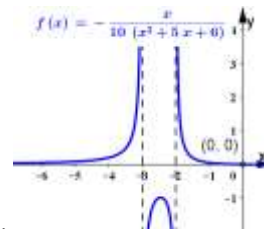
123. $D_f = (-\infty, \infty)$,
 $R_f = [-4, \infty)$



125. $D_f = (-\infty, \infty)$,
 $R_f = (-\infty, \infty)$



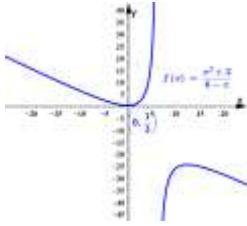
127. $D_f = (-\infty, \infty)$,
 $R_f = [0, \infty)$



129.

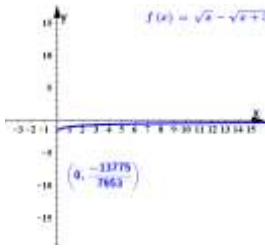
$$D_f = (-\infty, -3) \cup (-3, -2) \cup (-2, \infty),$$

$$R_f = (-\infty, -1] \cup (0, \infty)$$



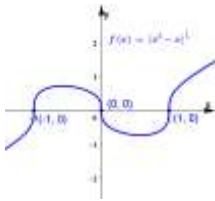
131.

$$D_f = (-\infty, 6) \cup (6, \infty)$$



133.

$$D_f = [0, \infty), R_f = [-\sqrt{3}, 0)$$



135.

$$D_f = (-\infty, \infty), R_f = (-\infty, \infty)$$

137. $T = 8\pi, A = 2$

139. $T = 2\pi, A = \frac{1}{4}$

141. $T = \pi, c = \frac{\pi}{3}, A = 1,$

desplazamiento de fase: $\frac{\pi}{6}$

143. a) $f(x) = 3\cos x,$

b) $g(x) = \cos x + 1$ y

c) $h(x) = \cos(2x)$

145. a) $f(x) + g(x) = x^2 + 3x + 2 \quad D_{f+g} = \mathbb{R},$

b) $\frac{f(x)}{g(x)} = \frac{x^2 + 2x + 1}{x + 1}, D_{f/g} = \mathbb{R} - \{-1\}$

147. a) $fg(x) = \frac{x^2}{x^2 - 1}, D_{fg} = \mathbb{R} - \{-1, 1\},$

b) $\frac{f(x)}{g(x)} = \frac{x - 1}{x + 1}, D_{f/g} = \mathbb{R} - \{-1, 1\}$

149. a) $f(x) - g(x) = 2x, D_{f-g} = \mathbb{R},$

b) $fg(x) = 9 - x^2, D_{fg} = \mathbb{R}$

151. a) $f(g(x)) = x^2 - 3, D_{f \circ g} = \mathbb{R};$

b) $g(f(x)) = (x - 3)^2, D_{g \circ f} = \mathbb{R};$

c) $f(f(x)) = x - 6, D_{f \circ f} = \mathbb{R};$

d) $g(g(x)) = x^4, D_{g \circ g} = \mathbb{R}$

153. a) $f(g(x)) = x, D_{f \circ g} = [1, \infty);$

b) $g(f(x)) = |x|, D_{g \circ f} = \mathbb{R},$

c) $f(f(x)) = x^4 + 2x^2 + 2, D_{f \circ f} = \mathbb{R};$

d) $g(g(x)) = \sqrt{\sqrt{x-1}-1}, D_{g \circ g} = [2, \infty)$

155. a) $f(g(x)) = \frac{x^3 + 1}{x},$ b) $D_{f \circ g} = \mathbb{R} - \{0\},$

b) $g(f(x)) = \frac{x^2}{x^3 + 1}, D_{g \circ f} = \mathbb{R} - \{-1\},$

c) $f(f(x)) = \frac{x^9 + 4x^6 + 3x^3 + 1}{x^8 + 2x^5 + x^2},$
 $D_{f \circ f} = \mathbb{R} - \{-1, 0\},$

d) $g(g(x)) = x, D_{g \circ g} = \mathbb{R} - \{0\}$

157. a) $f(g(x)) = \sqrt{\sin(x)},$
 $D_{f \circ g} = [2n\pi, (2n+1)\pi] \text{ con } n \in \mathbb{Z},$

b) $g(f(x)) = \sin \sqrt{x}, D_{g \circ f} = [0, \infty);$

c) $f(f(x)) = \sqrt[4]{x}, D_{f \circ f} = [0, \infty);$

d) $g(g(x)) = \text{sen}(\text{sen } x)$, $D_{g \circ g} = \mathbb{R}$

159. a) 3, b) 0, c) 12, d) 8, e) 1 y f) 9.5.

161. a) 3, b) 6, c) 6, d) 5, e) 5 y f) 5.8.

165. a) 27840, b) -5 y c) 0

167. $f^{-1}(x) = \frac{3x+1}{x+1}$, $D_{f^{-1}} = \mathbb{R} - \{-1\}$ y
 $R_{f^{-1}} = \mathbb{R} - \{3\}$.

169. $f^{-1}(x) = \frac{1}{5}(\ln(x)-1)$, $D_{f^{-1}} = (0, \infty)$,
 $R_{f^{-1}} = \mathbb{R}$

171. Inyectiva en $(-1, \infty)$, $D_{f^{-1}} = -e^{\frac{1}{2}x} - 1$,
 $R_{f^{-1}} = \mathbb{R}$

173. Inyectiva en $\left[0, \frac{\pi}{3}\right]$, $f^{-1}(x) = \frac{1}{3} \arccos(4x)$,

$D_{f^{-1}} = \left[-\frac{1}{4}, \frac{1}{4}\right]$, $R_{f^{-1}} = \left[0, \frac{\pi}{3}\right]$.

175. $f^{-1}(x) = (x-2)^2$, $D_{f^{-1}} = [2, \infty)$,
 $R_{f^{-1}} = [0, \infty)$.

177. $f^{-1}(x) = -2\sqrt{1+x^2}$, $D_{f^{-1}} = [0, 1]$,
 $R_{f^{-1}} = [0, 2]$.

179. $f^{-1}(x) = -\frac{1}{3}e^x + 2$, $D_{f^{-1}} = \mathbb{R}$,
 $R_{f^{-1}} = (-\infty, 2)$

181. Falso

183. Falso

185. Verdadero

187. Verdadero

189. a) $\frac{2}{3}$, b) $\frac{\sqrt{5}}{3}$ y c) $\frac{2}{\sqrt{5}}$

191. $D_f = [-1, 0]$, $R_f = \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

193. $D_f = \mathbb{R}$, $R_f = \left[3 - \frac{\pi}{2}, 3 + \frac{\pi}{2}\right]$

195. $D_f = \mathbb{R}$, $R_f = [4 - \pi, 4]$

197. 3

199. -3

201. -2

203. 4

205. $\frac{1}{\sqrt{2}}$

207. $e^x = 4$

209. $e^4 + 1 = x$

211. $x = \log_2(9) - 5$

213. $x = 5$

215. $x = 0, x = \ln 2$

217. $x = \frac{\ln(2)+1}{\ln(7)-1}$

219. $x = \frac{\sqrt{4e+25}+1}{2}$

221. $x = \frac{-\ln(2) + \ln(\sqrt{41}-1)}{\ln(3)}$

223. $x = 2$

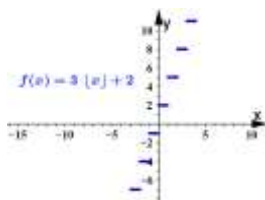
225. $f(x) = \begin{cases} 2 & \text{si } x < -2 \\ -\frac{2}{3} & \text{si } -2 \leq x < 1 \\ 2x-2 & \text{si } x \geq 1 \end{cases}$

227. $f(x) = \begin{cases} 0 & \text{si } -2 < x \leq 0 \\ 1 & \text{si } 0 < x \leq 2 \\ \sqrt{4-(x-4)^2}+1 & \text{si } 2 < x \leq 6 \end{cases}$

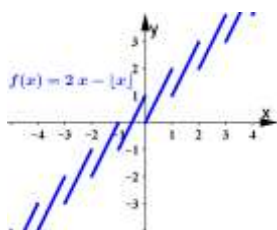
229. $f(x) = \begin{cases} 6-x & \text{si } x < 6 \\ x-6 & \text{si } x \geq 6 \end{cases}$

$$231. f(x) = \begin{cases} (x-1)(x+3) & \text{si } x < 1 \\ (1-x)(x+3) & \text{si } 1 \leq x \leq 3 \\ (x-1)(x+3) & \text{si } x > 3 \end{cases}$$

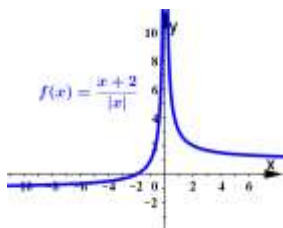
$$233. f(x) = \begin{cases} 3x^2 + 4x - 1 & \text{si } x < -\frac{2}{3} \\ 1 - 4x - 3x^2 & \text{si } -\frac{2}{3} \leq x \leq \frac{1}{2} \\ 3x^2 + 4x - 1 & \text{si } x > \frac{1}{2} \end{cases}$$



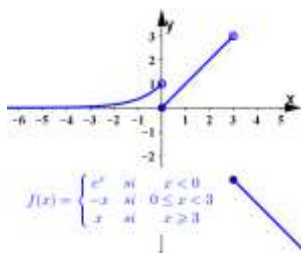
235.



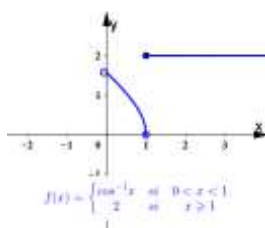
237.



239.



241.



243.

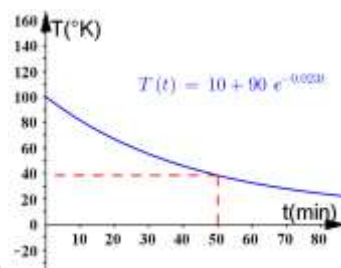
$$245. f(n) = \begin{cases} 675n & \text{si } 0 < n < 10 \\ 550n & \text{si } n \geq 10 \end{cases}$$

247. a) \$283.9, b) \$319.0

$$249. \text{ a) } T(t) = 10 + (100 - 10)e^{-kt}$$

b) $k = 0.023$

c) 38.49°C



d)

e) $t = 35.25 \text{ min}$

251. a) 6 especies

b) $A = 11,941.69 \text{ mi}^2$

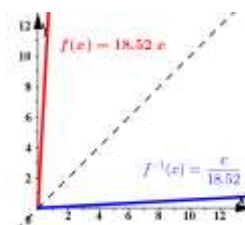
253. a) $S(x) = 200 + 0.8x$

b) \$1800

c) 2875 km

255. a) \$4630

$$\text{b) } f^{-1}(x) = \frac{x}{18.52}$$



c)

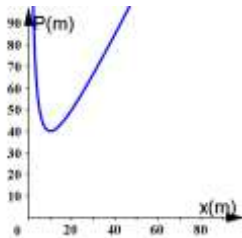
d) f determina la conversión de dólares a pesos y f^{-1} la conversión de pesos a dólares

$$257. \text{ a) } P(x) = \frac{2x^2 + 200}{x}$$

b)

| | |
|-----|--------|
| x | $P(x)$ |
|-----|--------|

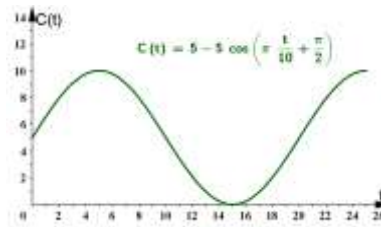
| | |
|----|--------|
| 0 | ∅ |
| 5 | 50 |
| 10 | 40 |
| 15 | 43.33 |
| 20 | 50 |
| 25 | 58 |
| 30 | 66.66 |
| 35 | 75.71 |
| 40 | 85 |
| 45 | 115.55 |
| 50 | 104 |



259. $V(z) = 6z^3 - 6z^2$

261. a) $N(t) = N_0 e^{rt}$

b) 180,000 bacterias



263.

265. $A(h) = 2h\sqrt{8-h^2}$

267. a) $k = 2.81$, b) $x = 0.428 \text{ g/L}$

269. $A(x) = \frac{x^2}{4} \pi$

271. $A(r) = 2r^2$

Soluciones a la evaluación de la competencia de la unidad 2

1. V
2. F
3. F
4. V
5. F
6. V
7. V
8. F
9. V
10. F
11. F
12. F
13. F
14. F
15. V
16. Exponencial
17. La función identidad $y = x$
18. $A = \frac{3}{2}$ y $T = 4$
19. -0.430301217...

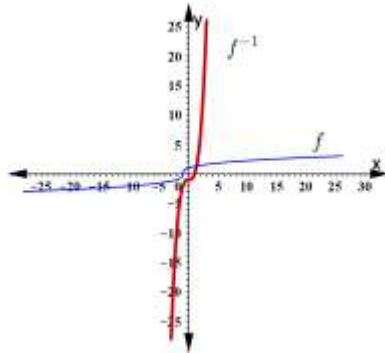
20. $(-\infty, 4) \cup (4, 10)$
21. $A = 4$
22. $P(A) = 3\sqrt{2A}$
23. Al origen
24. $(fg)(x) = 2x \ln(x-1); x > 3$
25. Inversa
26. $h(x) = 2 - e^{x+3}$
27. $f(x) = -\frac{1}{2}x + 1$
28. $(f+g)(x) = \frac{2x^3 + 3x^2 - x - 2}{2x + 3}$
29. $D_g = \mathbb{R} - \left\{-\frac{3}{2}\right\}$ y $R_g = \mathbb{R} - \left\{\frac{1}{2}\right\}$
30. $\frac{f(x+a) - f(x)}{a} = \frac{1}{\sqrt{x+a-1} + \sqrt{x-1}}$
31. a) $f(0) = 9$, b) $f(-10) = 91$ y c) $f(h-1) = |h^2 - 2h - 8|$
32. a)

$$f: \mathbb{R} \rightarrow \mathbb{R}$$

| | | | | | | | |
|--------|----|---|---|---|---|---|----|
| x | - | - | - | - | 0 | 7 | 26 |
| $f(x)$ | -3 | - | - | 0 | 1 | 2 | 3 |
| | 28 | 9 | 2 | 1 | | | |

$$f^{-1}: \mathbb{R} \rightarrow \mathbb{R}$$

| | | | | | | | |
|-------------|----|---|---|---|---|---|----|
| x | -3 | - | - | 0 | 1 | 2 | 3 |
| $f^{-1}(x)$ | - | - | - | - | 0 | 7 | 26 |
| | 28 | 9 | 2 | 1 | | | |

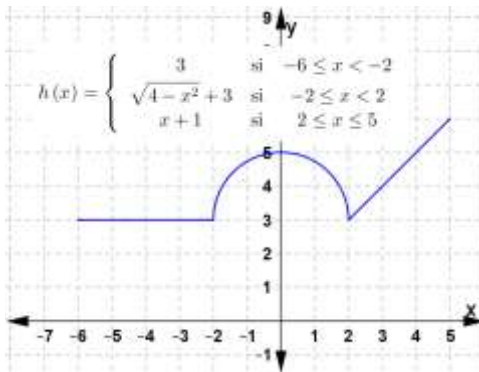


b)

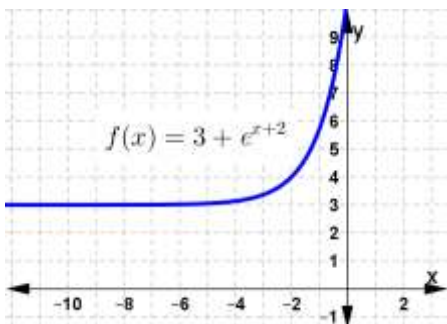
c) $f(x) = \sqrt{x+1}$

d) $f^{-1}(x) = x^2 - 1$

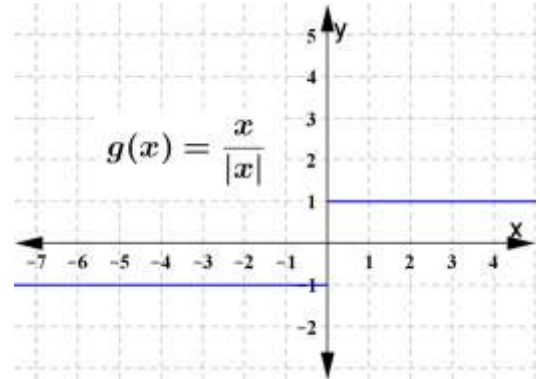
33.



34.



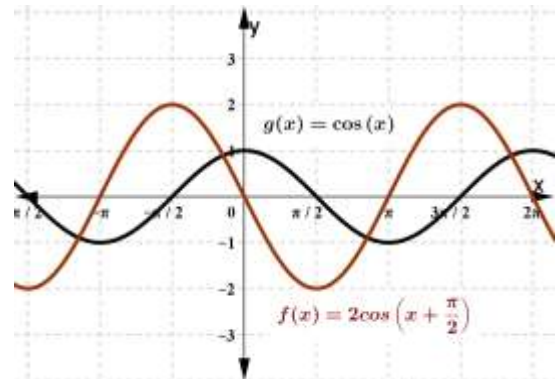
35.



36. Alargamiento vertical por un factor de 2,
 $f(x) = 2g(x)$ y desplazamiento
horizontal

a la izquierda en $\frac{\pi}{2}$ unidades,

$$f(x) = g\left(x + \frac{\pi}{2}\right).$$



37.

a) $h_1(x) = \frac{1}{3} \lfloor x \rfloor$

b) $h_2(x) = -\lfloor x \rfloor$

a) $h_3(x) = \lfloor x \rfloor + 2$

38. a) $f(x) + g(x) = \frac{2x^2 - 4}{x^2 - 1}$,

$$D_{f+g} = \mathbb{R} - \{-1, 1\}$$

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

$$D_{g/f} = \mathbb{R} - \{-1, 1, 2\}$$

39.

a) $g(x)$ es par

b) $h(x)$ carece de simetría

c)

40.

a) $(f \circ g)(x) = \frac{1}{-x}, D_{f \circ g} = (-\infty, 0)$

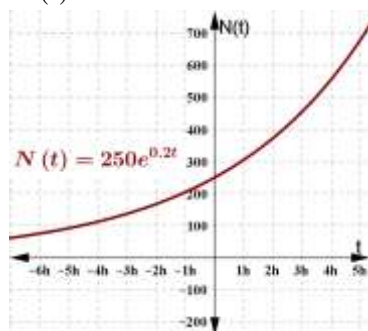
b) $g(f(x))$ no definida

41. $f^{-1}(x) = \frac{1}{2} \ln\left(\frac{x+1}{4}\right) - \frac{3}{2}, D_{f^{-1}} = (-1, \infty)$

, $R_{f^{-1}} = \mathbb{R}$

42.

a) $N(t) = 250e^{0.2t}$



b)

c) $N(5) = 250e^{0.2(5)} = 697$ bacterias

43.

a) 2230.65 euros

b) $f^{-1}(x) = \frac{50000}{44613}x$

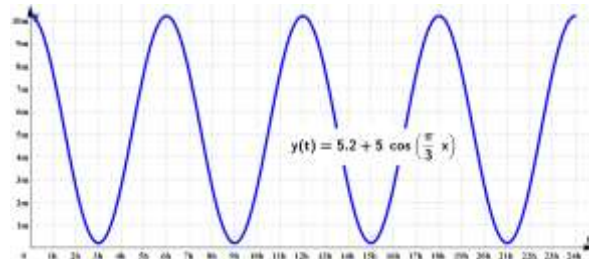
c) La función inversa es la conversión de euros a dólares

44.

a) $V(t) = 150,000 - 22500t$

b) 6.6 años

45.



a)

b) 10.2 m

c) 0.2 m

d) $T = 6$ h

e) $A = 5$ metros

Soluciones de los ejercicios impares del desarrollo de la competencia de la unidad 3

1. 13

31. 24

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

3. 2

33. 2.3

55. 11

5. $\cancel{}$

35. -16

57. $\cancel{}$

7. $\cancel{}$

37. 2

9. $\cancel{}$

39. $-\frac{1}{a}$

59. $\frac{1}{2}(-\sqrt{2} - 4)$

11. 3

41. $\frac{\sqrt{10}}{15}$

61. $\cancel{}$

13. 1

43. $\frac{891}{8}$

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

15. 1

45. 2

65. 1

17. 4

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

67. 16

19. 50

49. $4(a-b)$

69. $\cancel{}$

21. $\cancel{}$

51. $-\frac{1}{r^2}$

71. $4n$

23. $\cancel{}$

73. $20\sqrt{2}$

25. 1

75. $-\frac{1}{8}$

27. 1

29. 3

77. 0

79. 4

81. $\frac{1}{\sqrt{h}}$

83. -1

85. 4

87. \cancel{A}

89. $\cos(s)$

91. 0

93. $-\frac{1}{4}$

95. 0

97. 1

99. 16

101. 4

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

105. $\frac{5}{2}$ (105)

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

109. $\frac{1}{32}$

111. 1

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

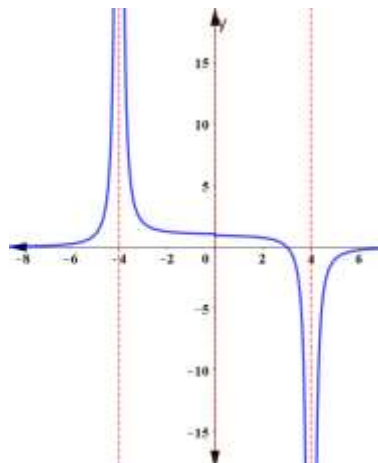
115. -4

117. e

119. 0

121. ∞

123.



125. a) $\frac{2}{5}$ b) 2

127. a) 141 palabras

b) 157 palabras

129. a); c); d); e)

131. f)

133. a); b); d); e)

135. a); d); e)

137. f)

139. $y = 0; x = -1; x = 1$

141. $y = 0; x = 0; x = 1$

143. $y = 1; y = 0$

145. $y = 1; x = -1$

147. $y = -1; x = 0$

149. $y = x + 2; x = 1$

151. $y = -10x + 25; x = -2$

153. Continua

155. Continua

157. Continua

159. Discontinua

161. Discontinua

163. $m = 1$

165. $m = n = 5$

167. $n = 6$

169.

Discontinua en $x = -1$;

Continua en $\mathbb{R} - \{-1\}$

171.

Discontinua en $\mathbb{R} - [-1, 1]$;

Continua en $[-1, 1]$

173.

Discontinua en $\mathbb{R} - [-4, 4]$;

Continua en $[-4, 4]$

Discontinua en $x = 2$;

175. Continua en $\mathbb{R} - \{2\}$

Discontinua en $x = 2$;

177. Continua en $\mathbb{R} - \{2\}$

179. $x \approx 3$

181. $x \approx 0$

183. $x \approx 2$

185. $x \approx 0$

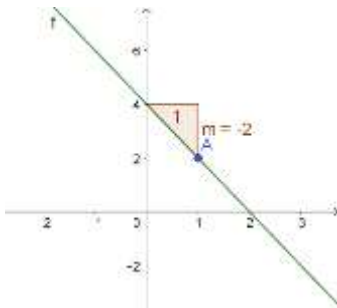
187. $x \approx 0$

Soluciones a la evaluación de la competencia de la unidad 3

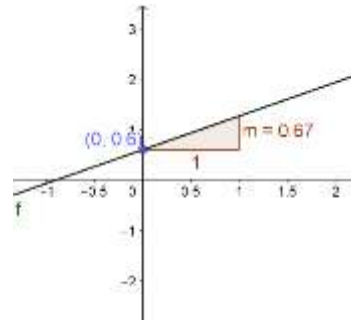
- | | | |
|-------|---------------------------|------------------------------------|
| 1. V | 18. V | 32. a) 360, 607; b) 1600 |
| 2. F | 19. F | 33. a) 73.3..., b) 218.915, c) 220 |
| 3. F | 20. V | 34. a) 0.137, 0.304; b) 90% |
| 4. V | 21. 2 | 35. c,d |
| 5. F | 22. 0.5 | 36. a,c |
| 6. V | 23. -0.5 | 37. d,e,f |
| 7. V | 24. 0 | 38. f |
| 8. V | 25. -1 | 39. e |
| 9. V | 26. $\frac{1}{2\sqrt{x}}$ | 40. ninguna |
| 10. V | 27. -1 | 41. d,e |
| 11. F | 28. 2.5 | 42. a,b,c |
| 12. V | 29. 1.5 | 43. f |
| 13. F | 30. $-\infty$ | 44. a,b |
| 14. V | 31. a) 5.5, b) 0.8 c) 1 | |
| 15. V | | |
| 16. F | | |
| 17. V | | |

Soluciones a los ejercicios impares del desarrollo de la competencia de la unidad 4

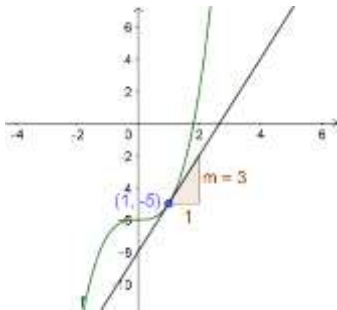
1. $m = -2$



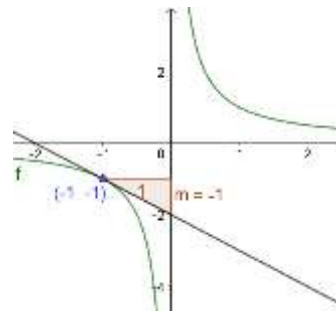
5. $m = \frac{2}{3}$



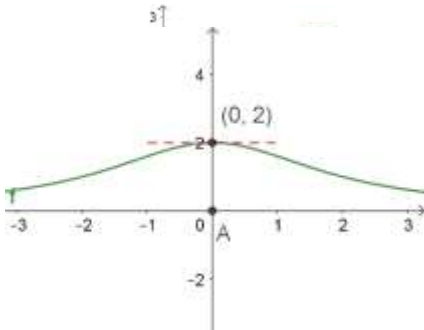
3. $m = 3$



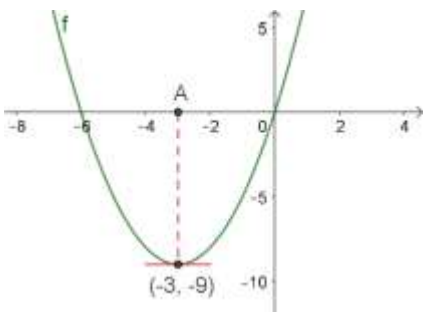
7. $m = -1$



9. $m = \frac{1}{12}$



11. (2, 6)



17. $f'(x) = 0$

19. $f'(x) = 2x$

21. $f'(x) = -8x$

23. $f'(x) = \frac{1}{2\sqrt{x}}$

25. $f'(x) = \frac{2}{x}$

27. $f'(x) = -\frac{1}{\sqrt{x^3}}$

29. $f'(x) = -\frac{4}{x^3}$

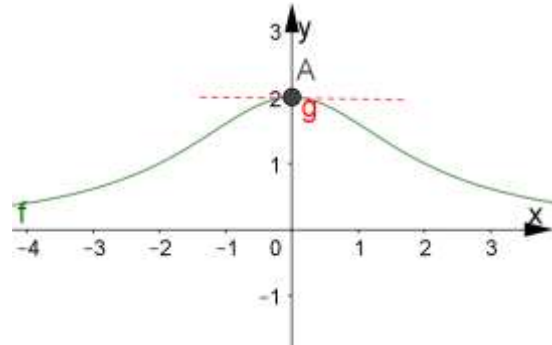
31. $y = -4x - 1$

33. $y = -6x - 2$

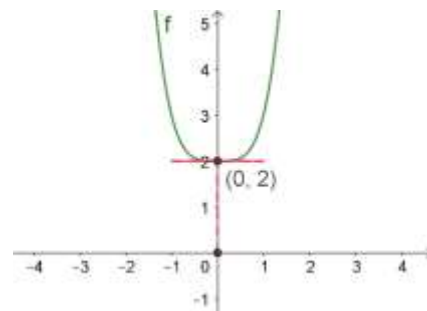
35. $y = 0$

37. $y = 3x - 1$

13. (0, 2)



15. (0, 2)



39. $y = -12x - 14$

41. $y' = 0$

43. $y' = -6$

45. $y' = 4x + 5$

47. $y' = -4 + 10x$

49. $y' = \frac{1}{2\sqrt{x}} + 2$

51. $y' = 5x^4 - 6x^2 + 8x$

53.

$y' = (x^2 - 3x + 2)(-4 + 3x^2) + (5 - x + x^3)(2x - 3)$

55. $y' = -\frac{3}{x^2}$

57. $y' = -\frac{10}{x^3}$

$$59. y' = \frac{10x}{(3-2x^2)^2}$$

$$61. dy = 3x^2 dx$$

$$63. dy = 2dx$$

$$65. dy = \frac{1}{2\sqrt{x}} dx$$

$$67. dy = dx$$

$$69. dy = (x \cos x + \operatorname{sen} x) dx$$

$$71. dy = \sec \theta \tan \theta d\theta$$

$$73. dy = (-t \operatorname{sen} t + \cos t) dt$$

$$75. dy = \left(\frac{1}{3\sqrt[3]{t^2}} - 1 \right) dt$$

$$77. dy = (1 + \ln t) dt$$

$$79. dy = 8\pi r dr$$

$$81. f'(x) = 2 \cos x - 3 \operatorname{sen} x$$

$$83. f'(x) = -x^2 \operatorname{sen} x + 2x \cos x$$

$$85. f'(x) = \frac{-2}{(\operatorname{sen} x - \cos x)^2}$$

$$87. f'(x) = -4 \operatorname{csc}^2 x + 3 \operatorname{csc} x \cot x$$

$$89. f'(x) = 4 \operatorname{sen} x \cos x$$

$$91. f'(x) = -\sec^3 x + \sec x \tan x - \sec x \tan^2 x$$

$$93. f'(x) = -12 \operatorname{sen} 6x$$

$$95. f'(x) = 3 \cos(2+3x)$$

$$97. f'(t) = (1-t) \sec(1+t) \tan(1+t) - \sec(1+t)$$

$$99. f'(t) = -\frac{1}{2} t^2 \operatorname{sen}\left(\frac{t}{2}\right) + 2t \cos\left(\frac{t}{2}\right)$$

$$101. f'(x) = 4(1+2x)$$

$$103. f'(x) = 8x(x^2+3)^3$$

$$105. f'(x) = 7 \left(x + \frac{1}{x} \right)^6 \left(1 - \frac{1}{x^2} \right)$$

$$107. g'(x) = \frac{-4x+12}{(x^2-6x+8)^{\frac{3}{4}}}$$

$$109. g'(x) = -\frac{3}{2} \frac{x^7}{\sqrt{1-x^3}} + 5x^4 \sqrt{1-x^3}$$

111.

$$h'(x) = 5 \left[\frac{x}{(x^2+x+1)^3} \right]^4 \frac{5x^6+12x^5+18x^4+14x^3+6x^2-1}{(x^2+x+1)^6}$$

113.

$$p'(r) = 3r^3 (r^{-1} + r^{-3} + r^{-5})^2 (-r^{-2} - 3r^{-4} - 5r^{-6}) + 3r^2 (r^{-1} + r^{-3} + r^{-5})^3$$

115.

$$q'(x) = \sqrt{x+1} \sqrt[3]{x-1} \frac{1}{4\sqrt[4]{x^3}} + \sqrt{x+1} \frac{1}{3\sqrt[3]{(x-1)^2}} \sqrt[4]{x} + \frac{1}{2\sqrt{x+1}} \sqrt[3]{x-1} \sqrt[4]{x}$$

$$117. f'(x) = -48(2-3 \operatorname{sen} 4x)^3 \cos 4x$$

$$119. f'(x) = 5 \operatorname{sen}^4 2x \cos 2x$$

$$121. f(x) = -\frac{1}{x^2} \sec\left(\frac{1}{x}\right) \tan\left(\frac{1}{x}\right)$$

$$123. f'(x) = -\frac{30}{x^3} \sec^3\left(\frac{5}{x^2}\right) \tan\left(\frac{5}{x^2}\right)$$

125.

$$f'(x) = \operatorname{sen}^2 x (1 - \operatorname{sen} x) + 2 \operatorname{sen} x \cos x (x + \cos x)$$

$$127. f'(x) = 2 \sec^2(\sec^2 x) \sec^2 x \tan x$$

$$129. f(x) = \frac{\tan^2 \sqrt{x} \sec \sqrt{x}}{2\sqrt{x}} + \frac{\sec^3 \sqrt{x}}{2\sqrt{x}}$$

$$131. y' = \frac{1}{x}$$

$$133. y' = \frac{1}{2x+2}$$

$$135. y' = \frac{1-2 \ln x}{x^3}$$

$$137. y' = \frac{1+2x}{4x\sqrt{\ln\sqrt{x}+x}}$$

$$139. y' = 3\ln^2 x + \ln^3 x$$

$$141. y' = \frac{2-x}{2x^3+x^2+2x+1}$$

$$143. y' = \frac{\operatorname{sen} x}{x} + \cos x(\ln x)$$

$$145. y = -\ln x \tan x + \frac{1}{x} \ln(\cos x)$$

$$147. y' = -(x+1)^{x-1} + (x+1)^x + (x+1)^x \ln(x+1)$$

$$149.$$

$$y' = \sqrt{x+1}(x-1)^2 + 2x\sqrt{x+1}(x-1) + \frac{1}{2}x \frac{(x-1)^2}{\sqrt{x+1}}$$

$$151. y' = -2^{\cos x} \operatorname{sen} x \ln 2$$

$$153. y' = \frac{2x+5}{15\sqrt[3]{x^2}\sqrt[5]{(x+1)^6}}$$

$$155. y' = e^x (\operatorname{sen} x)^{e^x} \ln(\operatorname{sen} x) + e^x (\operatorname{sen} x)^{e^x} \cot x$$

$$157. y' = 2e^x$$

$$159. y' = 2\pi x e^{\pi x^2}$$

$$161. y' = \frac{e^x}{2\sqrt{1+e^x}}$$

$$163. y' = \frac{e^x + e^{-x}}{2}$$

$$165. y' = x e^{\operatorname{sen} x} \cos x + e^{\operatorname{sen} x}$$

$$167. y' = 2 \left(e^{\frac{x}{2}} + e^{2x} \right) \left(\frac{1}{2} e^{\frac{x}{2}} + 2e^{2x} \right)$$

$$169. y' = e^{-(x+1)}$$

$$171. y' = -3e^{2x} \operatorname{sen} 3x + 2e^{2x} \cos 3x$$

$$173. y' = 20480e^{20x}$$

$$175. y' = e^{\sqrt{x^2+1}} \frac{x}{\sqrt{x^2+1}}$$

$$177. f'(x) = -\frac{1}{2\sqrt{x}} \operatorname{sech} \sqrt{x} \tanh \sqrt{x}$$

$$179. f'(x) = \frac{\sinh(\ln x)}{x}$$

$$181. f'(x) = 2x^3 \operatorname{sech} x^2 + 2x \tanh x^2$$

$$183. f'(x) = \frac{2 \operatorname{senh} x \operatorname{cosh} x}{\sqrt{\operatorname{senh}^2 x + \operatorname{cosh}^2 x}}$$

$$185.$$

$$f'(x) = \frac{(x \tanh x) \frac{\operatorname{sech}^2 x}{\tanh x} - (\ln(\tanh x))(x \operatorname{sech}^2 x + \tanh x)}{(x \tanh x)^2}$$

$$187. y' = \frac{1}{\sqrt{x^2-1}} + \sec^{-1} x$$

$$189. y' = \frac{\cos^{-1} x}{\sqrt{1-x^2}} - \frac{\operatorname{sen}^{-1} x}{\sqrt{1-x^2}}$$

$$191. y' = \frac{1}{x(1+\ln^2 x)}$$

$$193. y' = \frac{-2x}{x^4+1}$$

$$195. y' = \frac{1}{|x|\sqrt{x^2-1} \cos^{-1}\left(\frac{1}{x}\right)}$$

$$197. y' = \frac{2 \operatorname{sign}(4x^2-1)}{\sqrt{4x^2-1}}$$

$$199. y' = \frac{-1}{\sqrt{1-x^2}} + \operatorname{sech}^{-1} x$$

$$201. y' = \operatorname{sen} x \operatorname{cosh} x + \operatorname{senh} x \cos x$$

$$203. y' = \operatorname{sech}^2 \left(e^{\tanh^{-1} x} \right) e^{\tanh^{-1} x} \frac{1}{1-x^2}$$

$$205. y = -\frac{e^x}{\sqrt{1-e^{2x}}} + e^x \operatorname{sech}^{-1} e^x$$

$$207. y' = \frac{-2xy + 2y^1}{x^2 - 2x}$$

$$209. y' = \frac{2x^5 - 4x^3y - x^2 + 2xy^4}{2x^4y - 4x^2y^3 + 2y^5 + y^2}$$

$$211. y' = \frac{-2y}{3x^2y^2 - 6xy^3 - 2x + 3y^4}$$

$$213. y' = \frac{y \cos x - y + \cos y}{x \operatorname{sen} y + x - \operatorname{sen} x}$$

$$215. y' = \frac{1 - y \cos(xy)}{1 + x \cos(xy)}$$

$$217. \frac{dy}{dx} = -\frac{x}{2y}; \left. \frac{dy}{dx} \right|_{(-1,1)} = \frac{1}{2}$$

$$219. \frac{dy}{dx} = \frac{-2x - 2y - \operatorname{sen}(x-y)}{2x + 2y - \operatorname{sen}(x-y)}$$

$$\left. \frac{dy}{dx} \right|_{(0.5,0.5)} = -1$$

$$221. \frac{dy}{dx} = \frac{1}{y^3 + y}$$

$$223. \frac{dy}{dx} = \frac{4x\sqrt{x+y} - 1}{1 - 4y\sqrt{x+y}}$$

$$225. \frac{dy}{dx} = \frac{9x - 2x(x^2 + y^2)}{9y + 2y(x^2 + y^2)}$$

$$227. \frac{dy}{dx} = 2\sqrt{y}$$

$$229. \frac{dy}{dx} = \frac{9(x-1)}{4(y+2)}$$

$$231. \frac{dy}{dx} = -\frac{\sec^2 x}{\sec y \tan y}$$

$$233. \frac{dy}{dx} = \frac{1}{3xy^2 + 3y^3 - 1}$$

$$235. \frac{dy}{dx} = -\frac{y(\sqrt[3]{xy} + \sqrt[3]{x})}{x(\sqrt[3]{xy} + \sqrt[3]{x})}$$

$$237. f''(x) = -108 \cos(3x) + 16 \operatorname{sen}(2x)$$

$$239. f''(x) = 4e^{2x} \cos x + 3e^{2x} \operatorname{sen} x$$

$$241. f''(x) = -2 \operatorname{sen}^2 x + 2 \cos^2 x$$

$$243. f''(x) = \frac{-1}{(1-2x)^{\frac{3}{2}}}$$

$$245. f''(x) = 6 \operatorname{sen}^2 x (1 + \cos x) - 3 \cos x (1 + \cos x)^2$$

$$247.$$

$$\frac{d^4 y}{dx^4} = 5 \sec^3 x + 11 \sec x \tan^2 x + 12 \sec x \tan^4 x + 12 \sec^3 x \tan^2 x$$

$$249. \frac{d^2 y}{dx^2} = -\frac{1}{y} - \frac{x^2}{y^3}$$

$$251. \frac{d^4 y}{dx^4} = 48$$

$$253. \frac{d^4 y}{dx^4} = \frac{96}{x^5}$$

$$255. \frac{d^2 y}{dx^2} = \frac{2y \ln y + y \ln^2 y}{x^2}$$

Solución a evaluación de la Competencia de la unidad 4

- | | | | | |
|------|------|--------|-------|-------|
| 1. V | 5. F | 9. F | 13. F | 17. F |
| 2. F | 6. V | 10. V | 14. F | 18. F |
| 3. V | 7. F | 11. V | 15. V | 19. V |
| 4. V | 8. F | 12. V. | 16. F | 20. V |

$$21. y' = 30x^4 + 12x^2 + 24x$$

$$22. y' = \frac{4x^8 + 8x^4 - 8x^2 - 4}{x^5}$$

$$23. y' = \frac{-\operatorname{sen} x \cos x}{\sqrt{1 + \cos^2 x}}$$

$$24. y' = \frac{\operatorname{sen} x - \cos x - 1}{(1 + \cos x)^2}$$

$$25. y' = \frac{e^x}{e^{2x} + 2e^x + 2}$$

$$26. y' = \frac{\tan x}{(1 + \sec x) \sqrt{1 - \ln\left(\frac{1 + \sec x}{2}\right)^2}}$$

$$27. y' = \frac{\tan x}{1 + x^2} + \sec^2 x \tan^{-1} x$$

$$28. y' = \operatorname{sen} x \ln(\sec x) - \operatorname{sen} x$$

$$29. y' = \frac{3}{2} \frac{e^x \ln^2(2\sqrt{1 + e^x})}{1 + e^x}$$

$$30. y = -\frac{16 \sec^2(4x)}{\tan^5(4x)}$$

31.

$$y' = \cos(e^{-x}) \sec^2(e^x) e^x + \tan(e^x) \operatorname{sen}(e^{-x}) e^{-x}$$

$$32. y' = \frac{-6 \cosh^2(x^{-2}) \sinh(x^{-2})}{x^3}$$

$$33. y' = \frac{x^2 - 2x - 1}{2(x^2 + 1)^{\frac{3}{2}} \sqrt{1 - x}}$$

$$34. y' = 5^x \ln 5$$

$$35. y' = \frac{5x^2 - 6x + 1}{x^4 + 4x^3 + 6x^2 + 4x + 1}$$

$$36. y' = -\frac{1}{2x\sqrt{x+1}}$$

$$37. y' = (2x^3 + 2x)e^{x^2} - (2x^3 - 2x)e^{-x^2}$$

38.

$$y' = 4(\ln(x^2) + 2) \operatorname{sen}^3(x \ln(x^2)) \cos(x \ln(x^2))$$

39.

$$y' = 3x^2 e^{-x} \cos x - x^3 e^{-x} \cos x - x^3 e^{-x} \operatorname{sen} x$$

$$40. y' = \frac{\cos(\operatorname{senh}(\operatorname{sen}^{-1}x)) \operatorname{cosh}(\operatorname{sen}^{-1}x)}{\sqrt{1 - x^2}}$$

$$41. \frac{d^2 y}{dx^2} = 6x + 6$$

$$42. \frac{d^3 y}{dx^3} = \frac{4 \ln x - 6}{x^3}$$

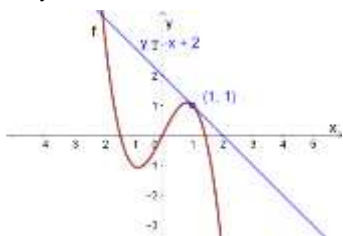
$$43. \frac{d^2 y}{dx^2} = -6 \operatorname{sen}^6 x + 30 \operatorname{sen}^4 x \cos^2 x$$

$$44. \frac{d^4 y}{dx^4} = \frac{840}{x^8}$$

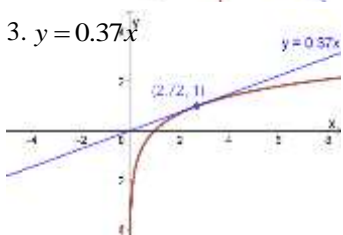
$$45. \frac{d^2 y}{dx^2} = \frac{(1 - 2x^2) \operatorname{sign}(x)}{x^2 (x^2 - 1)^{\frac{3}{2}}}$$

Soluciones a los problemas impares del desarrollo de la competencia de la Unidad 5

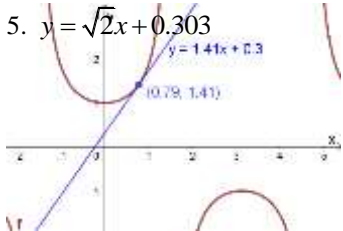
1. $y = -x + 2$



3. $y = 0.37x$



5. $y = \sqrt{2}x + 0.303$



7. $y = 4x - 4$; $y = -\frac{1}{4}x + \frac{9}{2}$

9. $y = -x + 8$; $y = x$

11. $y = -\frac{27}{32}x + \frac{145}{16}$; $y = \frac{32}{27}x - \frac{28}{9}$

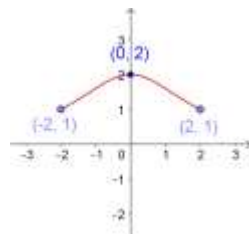
13. $P(-1, 5)$

15. $m = -1$

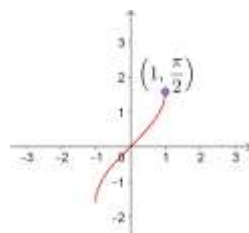
17. 79.2°

19. Max $(0, 2)$, Min $(-2, 1)$

Creciente $[-2, 0]$ Decreciente $[0, 2]$



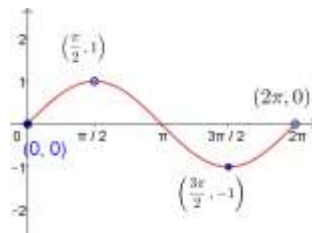
21. Max $(1, \frac{\pi}{2})$ Creciente $(0, 1]$



23. Max $(\frac{\pi}{2}, 1)$, Min $(\frac{3\pi}{2}, -1)$

Creciente $[0, \frac{\pi}{2}] \cup [\frac{3\pi}{2}, 2\pi]$ Decreciente

$[\frac{\pi}{2}, \frac{3\pi}{2}]$



25. $\{x = 0, x = 4\}$

27. $\{x = 4, x = 6\}$

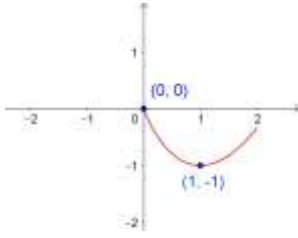
29. $\{t = 2\}$

31. $\{x = 0\}$

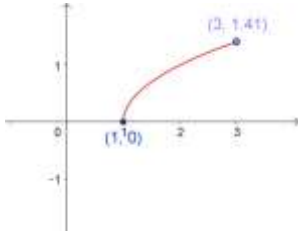
33. $\{t = -\sqrt{2}, t = \sqrt{2}\}$

35. Máximo absoluto $(0, 0)$

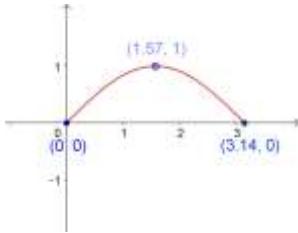
Mínimo absoluto $(1, -1)$



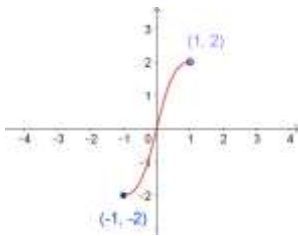
37. Máximo absoluto $(3, \sqrt{2})$
 Mínimo absoluto $(1, 0)$



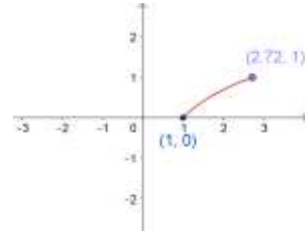
39. Máximo absoluto $(\frac{\pi}{2}, 1)$
 Mínimo absoluto $(0, 0), (\pi, 0)$



41. Máximo absoluto $(1, 2)$
 Mínimo absoluto $(-1, -2)$



43. Máximo absoluto $(e, 1)$
 Mínimo absoluto $(1, 0)$



45. Si, $\{c = 1\}$

47. No

49. No

51. No

53. Si, $\left\{c = \frac{5 - \sqrt{19}}{3}, c = \frac{5 + \sqrt{19}}{3}\right\}$

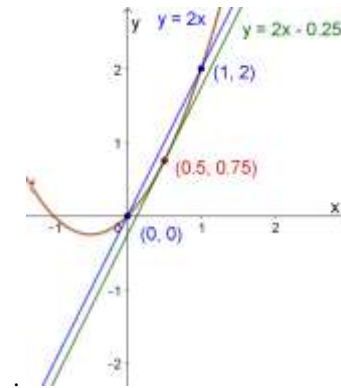
55. $c = 0$

57. $c = 0.6901$

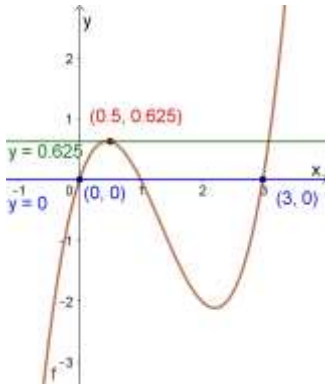
59. $c = -3.7641$

61. $\bar{v} = 240 \frac{Km}{h}$, cuando acelera y cuando desacelera.

63.



65.



67.

$$D = \mathbb{R}$$

Decreciente: $(-\infty, 2)$

Creciente: $(2, \infty)$

$$D = \mathbb{R} - \{0\}$$

69. Decreciente: $(-\infty, -1) \cup (1, \infty)$

Creciente: $(-1, 0) \cup (0, 1)$

$$D = \mathbb{R}$$

71. Decreciente: $(-\infty, 0)$

Constante: $[0, \infty)$

$$D = [0, 2\pi]$$

73. Decreciente: $(0, \pi)$

Creciente: $(\pi, 2\pi)$

$$D = [0, 2\pi]$$

75. Decreciente: $(-\infty, 0)$

Creciente: $(0, \infty)$

$$D = \mathbb{R} - \{0\}$$

77. Decreciente: $(-\infty, 4) \cup (4, \infty)$

79. $x_c = 2$

Mínimo: $f(2) = 2$

$$x_{c1} = -1; x_{c2} = 1$$

81. Mínimo: $f(1) = -4$

Máximo: $f(-1) = 0$

$$x_{c1} = 0; x_{c2} = 4$$

83. Mínimo: $f(0) = 9$

Máximo: $f(4) = 41$

85.

$$x_{c1} = -5$$

Mínimo: $f(-5) = -3$

87.

$$x_{c1} = -2; x_{c2} = 0; x_{c3} = 2$$

Máximo: $f(0) = 0$

89.

$$x_{c1} = -2$$

Mínimo: $f(-2) = -40$

$$x_{c1} = \frac{\pi}{2}; x_{c2} = \frac{3\pi}{2}$$

91. Mínimo: $f\left(\frac{3\pi}{2}\right) = -1 - \frac{\sqrt{3}}{2}$

$$\text{Máximo: } f\left(\frac{\pi}{2}\right) = 1 + \frac{\sqrt{3}}{2}$$

93. hacia arriba

95. No definida

97. hacia arriba

99. hacia arriba: $(-\infty, \infty)$

101. hacia arriba: $(-\infty, -2) \cup (2, \infty)$

hacia abajo: $(-2, 2)$

103. hacia arriba: $\left(\frac{\pi}{2}, \pi\right)$

hacia abajo: $\left(0, \frac{\pi}{2}\right)$

105. Mínimo: $f(3) = -28$

107. Mínimo: $f(-2) = -2$

109. Mínimo: $f(1) = 2$

111. Mínimo: $f(1) = -27$

113. Máximo: $f(1.0472) = 2.5981$
Mínimo: $f(5.236) = -2.5981$

115. Máximo: $f(-1) = 10$
Mínimo: $f(1) = 6$

117.

Interceptos : $x = 0, x = 20$
 $x_{c1} = 0; x_{c2} = 16$
Creciente: $[-\infty, 0] \cup [16, \infty)$
Decreciente: $[0, 16]$
Máximo: $f(0) = 0$
Mínimo: $f(16) = -52428.8$
Puntos de Inflexión: $(12, -33177.6)$
Cóncava abajo: $(-\infty, 12)$
Cóncava arriba: $(12, \infty)$

119.

Interceptos : $x = -1; x = 0, x = 1$
 $x_{c1} = -0.44; x_{c2} = 0.44$
Creciente: $(-\infty, -0.44] \cup [0.44, \infty)$
Decreciente: $[-0.44, 0.44]$
Máximo: $f(-0.44) = 0.68$
Mínimo: $f(0.44) = -0.68$
Puntos de Inflexión: $(0, 0)$
Cóncava abajo: $(-\infty, 0)$
Cóncava arriba: $(0, \infty)$

121

Interceptos : No hay
 $x_{c1} = -2; x_{c2} = 2$
Creciente: $(-\infty, 2] \cup [2, \infty)$
Decreciente: $[-2, 2]$
Máximo: $f(-2) = -4$
Mínimo: $f(2) = 4$
Puntos de Inflexión: No hay
Cóncava abajo: $(-\infty, 0)$
Cóncava arriba: $(0, \infty)$

123.

$x_{c1} = 0$
Creciente: $[0, \infty)$
Decreciente: $(-\infty, 0]$
Máximo: No hay
Mínimo: $f(0) = 0$
Puntos de Inflexión: $(-1.15, 0.25), (1.15, 0.25)$
Cóncava abajo: $(-\infty, -1.15), (1.15, \infty)$
Cóncava arriba: $(-1.15, 1.15)$

125.

No tiene números críticos
Decreciente: $(-\infty, 2) \cup (2, \infty)$
Máximo: No hay
Mínimo: No hay
Puntos de Inflexión: No hay
Cóncava abajo: $(-\infty, 2)$
Cóncava arriba: $(2, \infty)$
Asintotas : $y = 4; x = 2$

127.

$x_{c1} = -\sqrt{2}; x_{c2} = \sqrt{2}$
Creciente: $(-\infty, -\sqrt{2}] \cup [\sqrt{2}, \infty)$
Decreciente: $[-\sqrt{2}, \sqrt{2}]$
Máximo: $f(-\sqrt{2}) = 4\sqrt{2}$
Mínimo: $f(\sqrt{2}) = -4\sqrt{2}$
Puntos de Inflexión: $(0, 0)$
Cóncava abajo: $(-\infty, 0)$
Cóncava arriba: $(0, \infty)$

129.

No hay números críticos
Creciente: $(-\infty, \infty)$
Máximo: No hay
Mínimo: No hay
Puntos de Inflexión: $(0, -2)$
Cóncava abajo: $(-\infty, 0)$
Cóncava arriba: $(0, \infty)$

131.

$$x_{c1} = 4$$

Creciente: $(-\infty, 0) \cup [4, \infty)$

Decreciente: $(0, 4]$

Máximo: No hay

Mínimo: $f(4) = 6$

Puntos de Inflexión: No hay

Cóncava abajo: Nunca

Cóncava arriba: $(-\infty, 0) \cup (0, \infty)$

133.

No hay números críticos

Creciente: $(-\infty, 0) \cup (0, \infty)$

Decreciente: Nunca

Máximo: No hay

Mínimo: No hay

Puntos de Inflexión: No hay

Cóncava abajo: $(0, \infty)$

Cóncava arriba: $(-\infty, 0)$

135.

$$x_{c1} = -2; x_{c2} = 2$$

Creciente: $(-\infty, -2] \cup [2, \infty)$

Decreciente: $[-2, 2]$

Máximo: $f(-2) = 100$

Mínimo: $f(\sqrt{2}) = -92$

Puntos de Inflexión: $(0, 4)$

Cóncava abajo: $(-\infty, 0)$

Cóncava arriba: $(0, \infty)$

137. a) $\frac{dh}{dt} = 0.00159 \frac{\text{cm}}{\text{s}}$

b) $\frac{dr}{dt} = 0.000397 \frac{\text{cm}}{\text{s}}$

139. $\frac{dx}{dt} = 0.2142 \frac{\text{m}}{\text{s}}$

141. $\frac{ds}{dt} = 50 \frac{\text{km}}{\text{h}}$

143. $\frac{dx}{dt} = \frac{8}{3} \frac{\text{ft}}{\text{s}} = 2.666 \frac{\text{ft}}{\text{s}}$

145. a) $\frac{ds}{dt} = -737.9 \frac{\text{km}}{\text{h}}$

147. $\frac{dh}{dt} = 0.0497 \frac{\text{m}}{\text{s}}$

149. $x = 30, y = 15$

151. $x = 30$ departamentos

153. Del 1 al 19 a la baja, en el 20 está el mínimo y del 21 al 30 a la alza

155. $x = \frac{10}{3} \text{ cm}$

157. $r = 5.346 \text{ cm}, h = 10.69 \text{ cm}$

159. $d = 0.8165$

161. $A = 75\sqrt{3} \text{ cm}^2$

163. 0.022 rad/s

165. $V = 2.4184r^3$

167.

a) $A(x) = 4x^2 - 2500 + 8x\sqrt{625 - x^2}$

b) $A_{\text{max}} = 1545.08 \text{ cm}^2$

c) $A(\alpha) = 2500\text{sen } \alpha + 1500\text{cos } \alpha - 1500$

d) $\alpha = \tan^{-1}\left(\frac{1}{2}\right) = 26.57^\circ$ Es la misma área.

169. $\frac{3}{5}$

171. 1

173. 0

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

177. 0

179. 1

181. \sqrt{e}

$$183. -\frac{3}{2}$$

$$185. 1$$

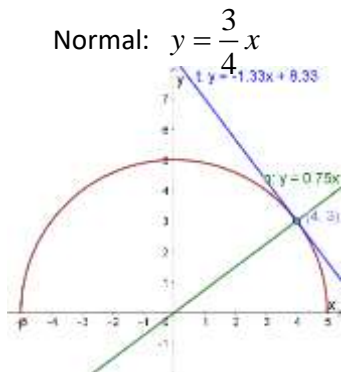
$$187. -\frac{1}{\pi}$$

$$189. \frac{1}{4}$$

Soluciones a evaluación de la competencia de la unidad 5

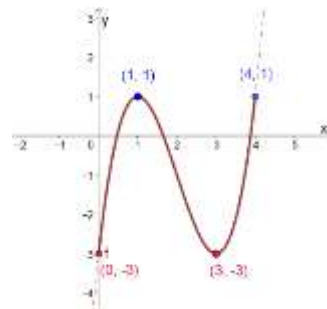
1. F
2. V
3. V
4. F
5. V
6. V
7. V
8. F
9. V
10. V
11. F
12. F
13. V
14. F
15. V

16. Tangente: $y = -\frac{4}{3}x + \frac{25}{3}$



17. $\theta = 59.04^\circ$
- 18.

| Valor de x | $f(x)$ | |
|--------------|-------------|-----------------|
| $x=0$ | $f(0) = -3$ | Mínimo absoluto |
| $x=1$ | $f(1) = 1$ | Máximo absoluto |
| $x=3$ | $f(3) = -3$ | Mínimo absoluto |
| $x=4$ | $f(4) = 1$ | Máximo absoluto |



19. Intervalos creciente y decreciente

| Valor de prueba x | Intervalos | | |
|---------------------|----------------|-------------|---------------|
| | $(-\infty, 0]$ | $[0, 6]$ | $[6, \infty)$ |
| $x = -1$ | $f'(-1) < 0$ | | |
| $x = 1$ | | $f'(1) < 0$ | |
| $x = 8$ | | | $f'(8) > 0$ |
| Comportamiento | decreciente | decreciente | creciente |

Intervalos de concavidad

| Valor de prueba x | Intervalos | | |
|---------------------|----------------------|---------------------|----------------------|
| | $(-\infty, 0)$ | $(0, 4)$ | $(4, \infty)$ |
| $x = -1$ | $f''(-1) > 0$ | | |
| $x = 1$ | | $f''(1) < 0$ | |
| $x = 8$ | | | $f''(8) > 0$ |
| Comportamiento | Cóncava hacia arriba | Cóncava hacia abajo | Cóncava hacia arriba |

20. Intervalos crecientes y decrecientes

| Valor de prueba x | Intervalos | | | |
|---------------------|-----------------|----------------------|---------------------|---------------|
| | $(-\infty, -2]$ | $[-2, -\frac{4}{3}]$ | $[-\frac{4}{3}, 0]$ | $[0, \infty)$ |
| $x = -3$ | $f'(-3) > 0$ | | | |
| $x = -1.5$ | | $f'(-1.5) > 0$ | | |
| $x = -1$ | | | $f'(-1) < 0$ | |
| $x = 1$ | | | | $f'(1) > 0$ |
| Comportamiento | creciente | creciente | decreciente | creciente |

21.

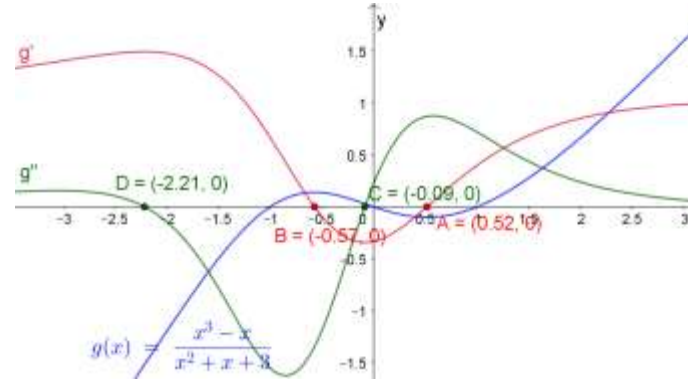
| Valor de prueba x | Intervalos | | | |
|------------------------|--------------------|-----------------|----------------|---------------|
| | $(-\infty, 0.921]$ | $(0.921, 2.53]$ | $(2.53, 3]$ | $(3, \infty)$ |
| $x = 0$ | $f'(0) < 0$ | | | |
| $x = 1$ | | $f'(1) > 0$ | | |
| $x = 2.53$ | | | $f'(2.53) < 0$ | |
| $x = 3$ | | | | $f'(3) > 0$ |
| Comportamiento | decreciente | creciente | decreciente | creciente |

| Valor de prueba x | Intervalos | | |
|------------------------|----------------------|---------------------|----------------------|
| | $(-\infty, 1.46)$ | $(1.46, 2.54)$ | $(2.54, \infty)$ |
| $x = -1$ | $f''(-1) > 0$ | | |
| $x = 2$ | | $f''(2) < 0$ | |
| $x = 3$ | | | $f''(3) > 0$ |
| Comportamiento | Cóncava hacia arriba | Cóncava hacia abajo | Cóncava hacia arriba |

22. $P = \left(\frac{1}{2}, \frac{1}{4}\right)$

23. $A = 4 \times 8 = 32$

24.

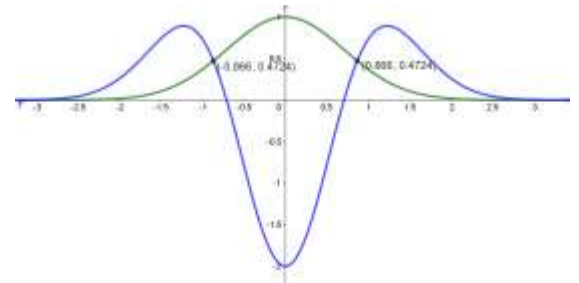


Máximo: $g(-0.57) = 0.14$

Mínimo: $g(0.52) = 0.1$

Inflexión: $(-0.09, 0.03)$

25. $(-0.8660, 0.4724)$ y $(0.8660, 0.4724)$



26. -0.048 m/s

27. $d = \sqrt{5}$

28.

29. \$120

30. No existe

31. No existe

32. 1

33. 1