

Conics

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Date _____ Period _____

15.1 I can solve quadratic equations and inequalities by completing the square

1) $n^2 + 14n + 40 = -8$

2) $m^2 + 12m + 20 = 9$

3) $n^2 + 16n + 20 = 4$

4) $x^2 + 20x - 42 = 2$

5) $b^2 + 10b - 19 = 5$

6) $v^2 - 14v + 26 = -7$

7) $x^2 - 18x + 75 = -3$

8) $r^2 + 4r - 70 = 7$

9) $8m^2 + 16m - 74 = 10$

10) $3x^2 + 12x - 73 = 5$

11) $4v^2 + 16v - 11 = 9$

12) $5x^2 - 10x - 85 = -10$

13) $2r^2 + 20r + 41 = 9$

14) $7n^2 + 14n + 13 = 8$

15) $10b^2 + 20b - 91 = -9$

16) $5n^2 - 20n - 11 = -10$

17) $7m^2 + 9m - 87 = -2$

18) $5n^2 - 11n - 10 = 6$

19) $9p^2 - 20p - 23 = 6$

20) $6k^2 - 8k + 1 = 9$

21) $10n^2 - 16n - 48 = 7$

22) $2x^2 + x + 3 = 4$

23) $3a^2 + 13a + 16 = 7$

24) $6x^2 + 5x - 48 = 10$

25) $2r^2 + 12r = -56$

26) $3v^2 + 26 = -6v$

27) $6n^2 = 36 + 12n$

28) $6x^2 - 48 = -12x$

29) $4x^2 + 5 = 8x$

30) $9n^2 = -18n - 86$

31) $10b^2 - 20b = 80$

32) $2a^2 + 16a = -62$

33) $n^2 - 5 = 15n$

34) $37 - 11x = -x^2$

35) $0 = -k^2 + 3k - 74$

36) $10v^2 - 60 = -v$

37) $0 = 24 - x^2 - 5x$

38) $22 = -n^2 - 13n$

39) $0 = -73 + 12p - 9p^2$

40) $0 = -65 - 17x - 10x^2$

41) $y > -x^2 - 8x - 18$

42) $y < 2x^2 - 4x - 2$

43) $y < x^2 + 4x + 6$

44) $y \leq x^2 - 8x + 13$

45) $y \leq 2x^2 - 16x + 30$

46) $y < -2x^2 - 8x - 11$

$$47) y \geq x^2 + 4x + 8$$

$$48) y > -2x^2 - 8x - 10$$

$$49) y \leq -x^2 - 3x - 3$$

$$50) y \geq -2x^2 - 6x$$

$$51) y < -\frac{1}{2}x^2 - \frac{5}{2}x$$

$$52) y \geq -\frac{1}{2}x^2 - \frac{9}{2}x - \frac{73}{8}$$

$$53) y \geq 2x^2 + 18x + 42$$

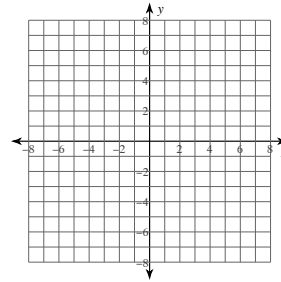
$$54) y > 2x^2 + 18x + \frac{87}{2}$$

$$55) y < -2x^2 - 10x - 15$$

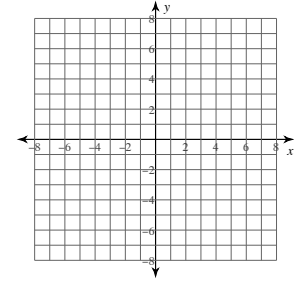
$$56) y > -x^2 + x - 2$$

15.2 I can graph circles and their translations from given equations or characteristics with and without technology

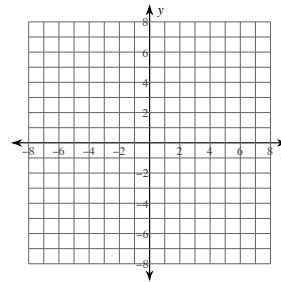
$$57) (x+3)^2 + \left(y + \frac{1}{2}\right)^2 = 6$$



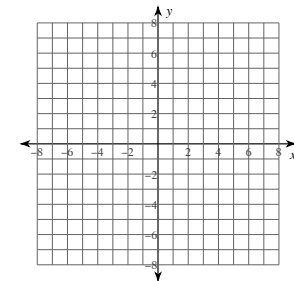
$$58) (x - \sqrt{15})^2 + (y+1)^2 = 4$$



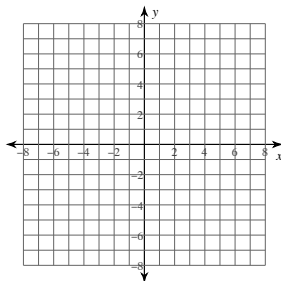
$$59) (x - 2\sqrt{3})^2 + (y+1)^2 = 9$$



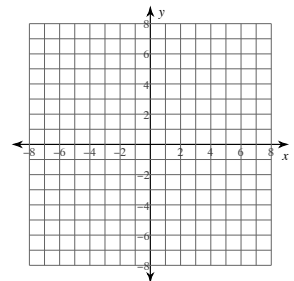
$$60) \left(x + \frac{5}{2}\right)^2 + \left(y + \frac{1}{2}\right)^2 = 1$$



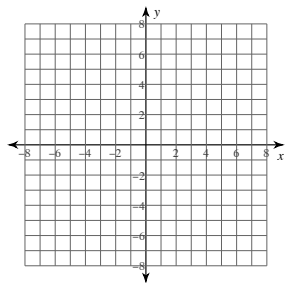
$$61) x^2 + y^2 + 6x - 2y + 9 = 0$$



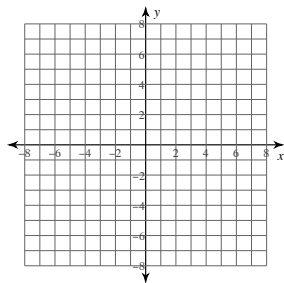
$$62) x^2 + y^2 + 8x + 4y + 14 = 0$$



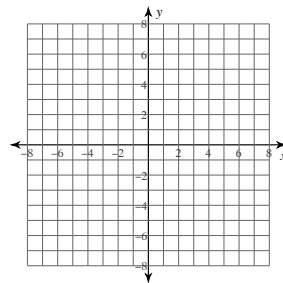
63) $x^2 + y^2 + 8x + 7 = 0$



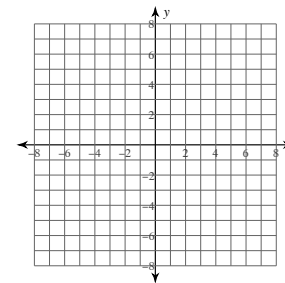
64) $x^2 + y^2 - 4x + 2y - 4 = 0$



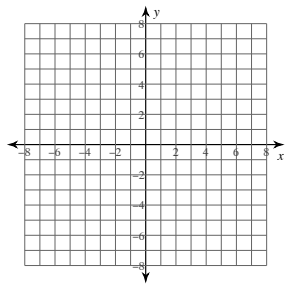
69) $x^2 + y^2 - 6x - 8y + 16 = 0$



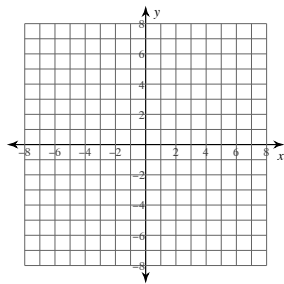
70) $x^2 + y^2 - 6x + 4y - 3 = 0$



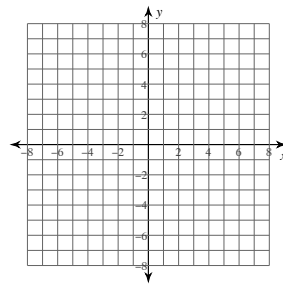
65) $x^2 + y^2 - 8x + 2y + 16 = 0$



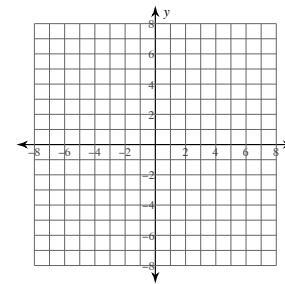
66) $x^2 + y^2 - 8x - 2y + 8 = 0$



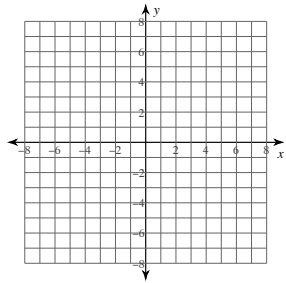
71) $x^2 + y^2 - 8x - 8y + 31 = 0$



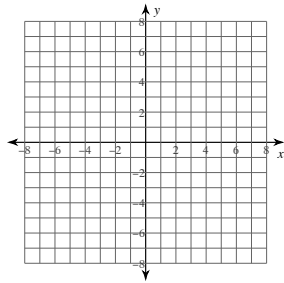
72) $x^2 + y^2 - 4x - 4y - 16 = 0$



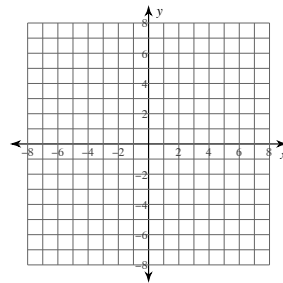
67) $x^2 + y^2 - 8x - 6y + 17 = 0$



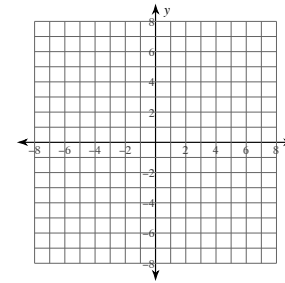
68) $x^2 + y^2 - 6x + 8y + 23 = 0$



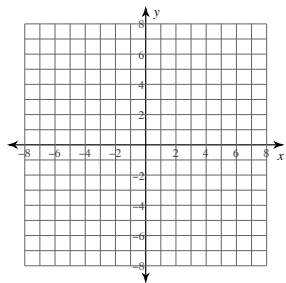
73) $7 + 2x^2 + 2y + 2y^2 = 14x$



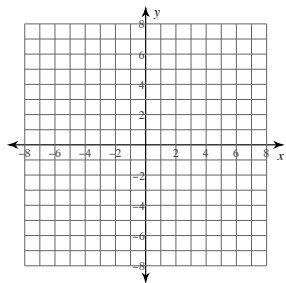
74) $4y - 1 + x^2 = 4x - y^2$



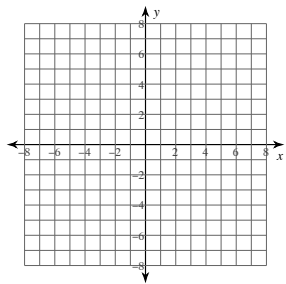
$$75) -6 + x^2 = 2x - y^2 + 6y$$



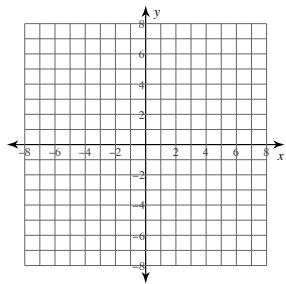
$$76) y^2 = -x^2 - 8 + 2y - 8x$$



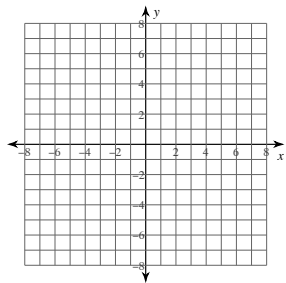
$$77) 0 = -18 - y^2 - x^2 - 8x - 6y$$



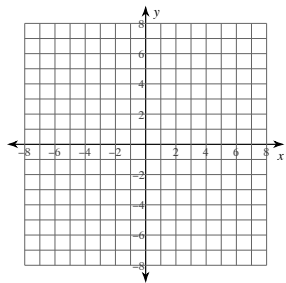
$$78) 2x - 8y = -13 - x^2 - y^2$$



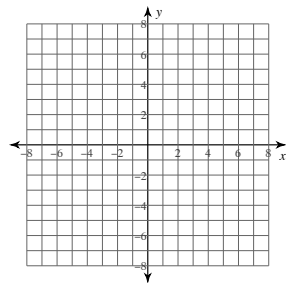
$$79) y^2 + x^2 - 6y = -14 + 6x$$



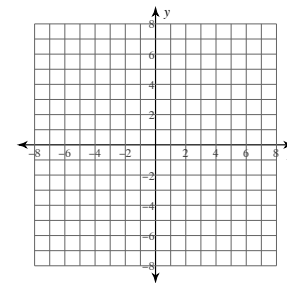
$$80) -33 = -y^2 - 2x - x^2$$



$$81) y^2 + x^2 = -2y + 24$$

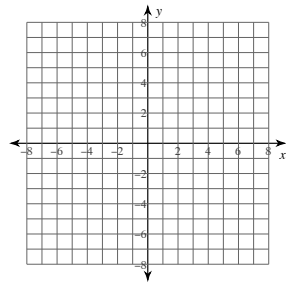


$$82) y^2 = -6x - x^2 - 4$$

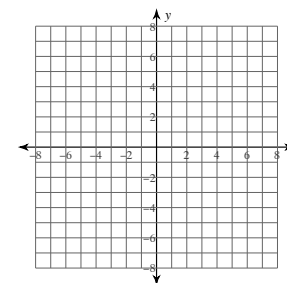


15.3 I can graph parabolas and their translations from given equations or characteristics with and without technology

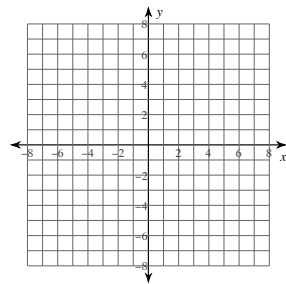
$$83) 4y + 4x = -x^2$$



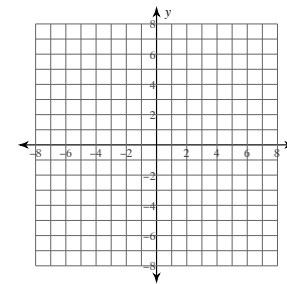
$$84) y = -\frac{1}{3}x^2 + \frac{10}{3}x - \frac{43}{3}$$



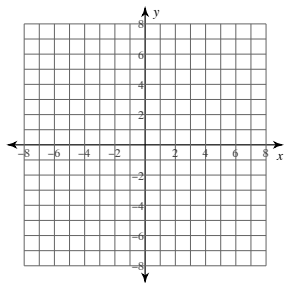
$$85) y = (x - 2)(x + 2)$$



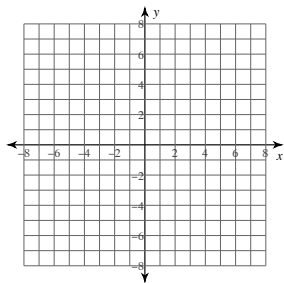
$$86) 2x^2 + 12x + y + 18 = 0$$



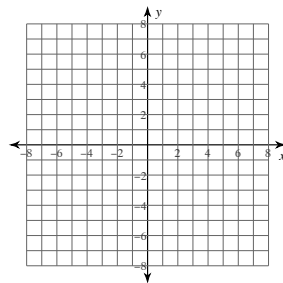
87) $2y - 5 = x^2 - 6x$



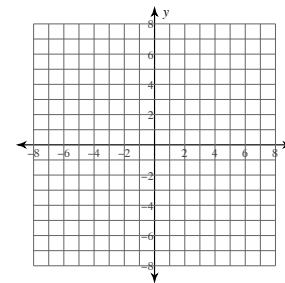
88) $y + x^2 + 7 = -2x$



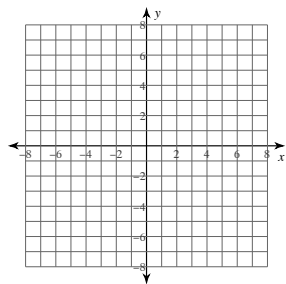
93) $x^2 + 8x + 15 + y = 0$



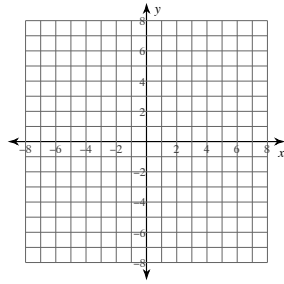
94) $x^2 - 11 + 3y = -2x$



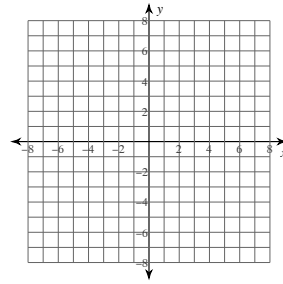
89) $-(y - 2) = (x - 1)^2$



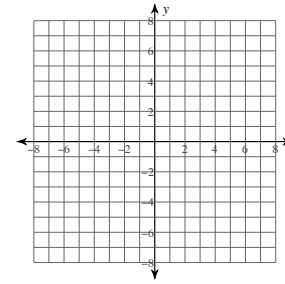
90) $y = x^2 - 3$



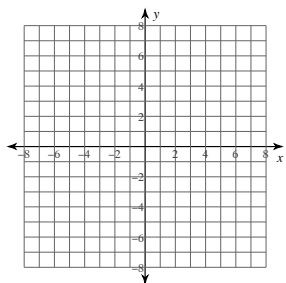
95) $x^2 + y + 3 = 0$



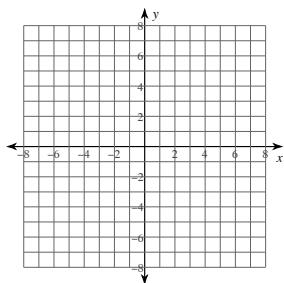
96) $y + 10x - x^2 = 27$



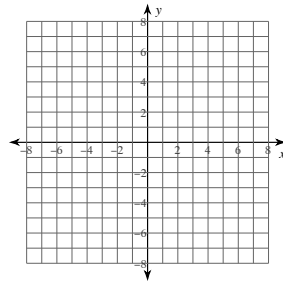
91) $y - 20x - 2x^2 = 45$



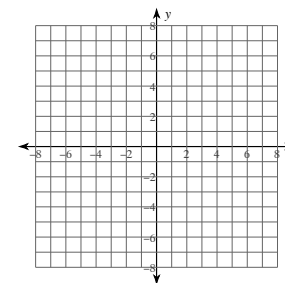
92) $-2x^2 = -y + 4 - 8x$



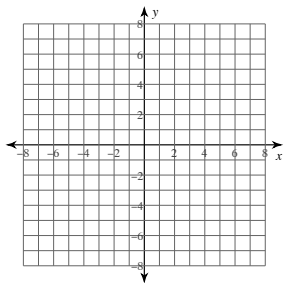
97) $y = -x^2 - 8x - 18$



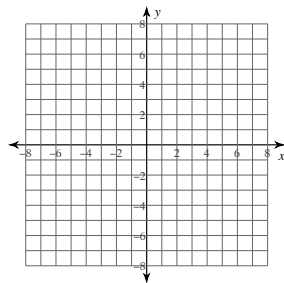
98) $y = -2(x - 1)^2$



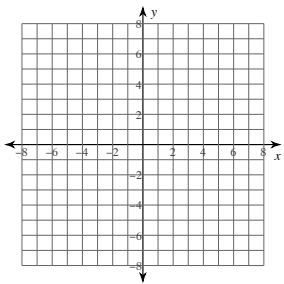
99) $5 - x^2 = -y$



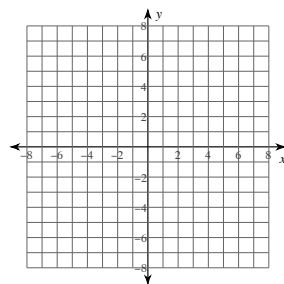
100) $-2x^2 + 16x + y - 30 = 0$



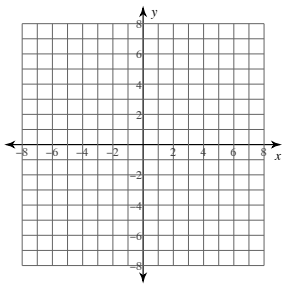
101) $y + 2x^2 = -8x - 10$



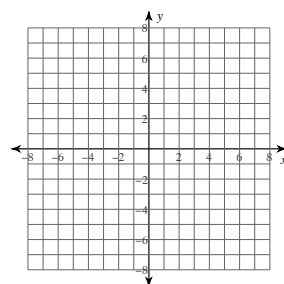
102) $y = \frac{1}{2}(x+4)(x+3)$



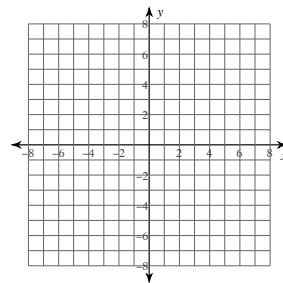
103) $x^2 + y = 3 + 2x$



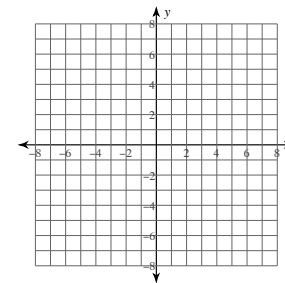
104) $2(y+1) = (x+5)^2$



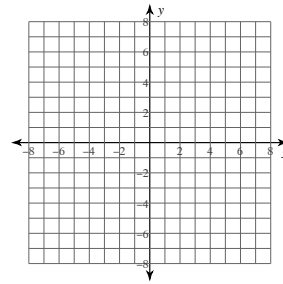
105) $0 = -y - 24x - 3x^2 - 53$



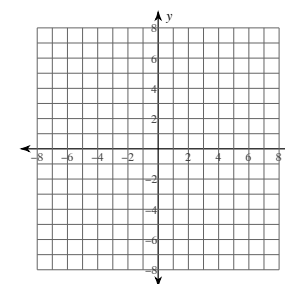
106) $0 = -x^2 + 10x - 27 - y$



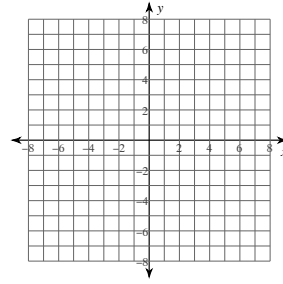
107) $y = \frac{1}{3}x^2 - \frac{10}{3}x + \frac{34}{3}$



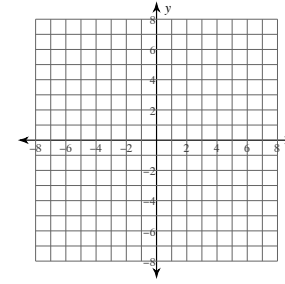
108) $-(y-3) = (x-4)^2$



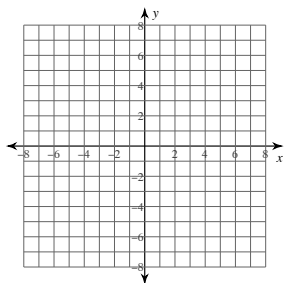
109) $-6x - 4 - x^2 = -y$



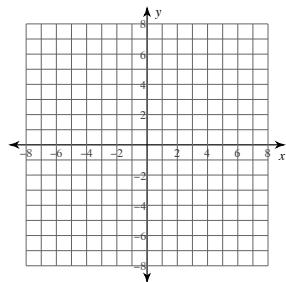
110) $-47 - 20x = 2x^2 - y$



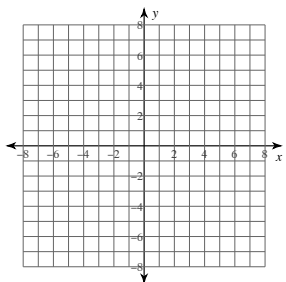
$$111) y = -2(x+2)^2 - 1$$



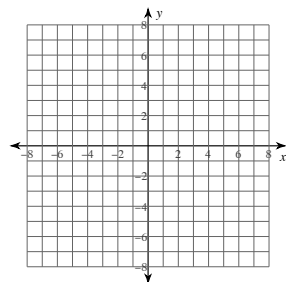
$$112) y = 2x^2 + 20x + 49$$



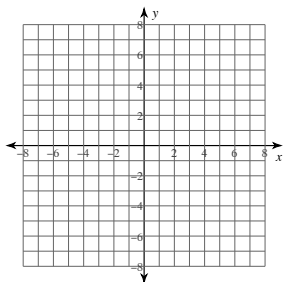
$$113) 24y + 53 = -3y^2 - x$$



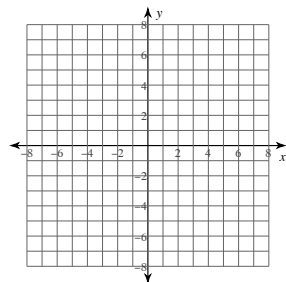
$$114) 2y^2 + x + 48 = -20y$$



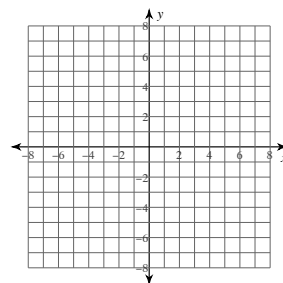
$$115) x = -5y^2 - 177 + 60y$$



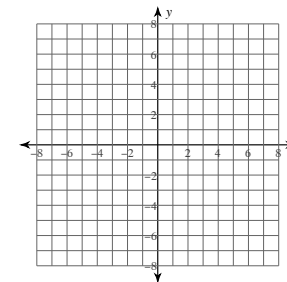
$$116) -7 - y^2 - 6y + x = 0$$



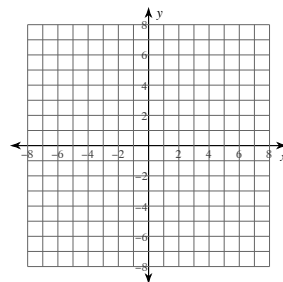
$$117) -\frac{1}{5}(x+3) = (y-2)^2$$



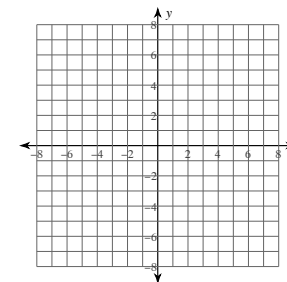
$$118) 2y^2 + x + 12y + 13 = 0$$



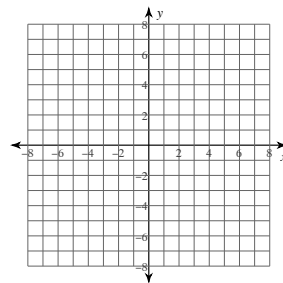
$$119) 0 = -x + 33 + y^2 + 12y$$



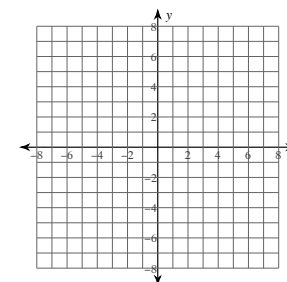
$$120) x - 2y + 2 = -y^2$$



$$121) y^2 + 10 = -8y - x$$



$$122) x = -\frac{1}{2}y^2 - y - \frac{13}{2}$$



15.4 I can determine characteristics of circles from their equations and graphs. Identify the center and radius of each.

123) $(x + 12)^2 + (y - 13)^2 = 21$

124) $(x - 2)^2 + (y - 14)^2 = 6$

125) $y^2 + x^2 + 30x = -6y - 230$

126) $(x + 2)^2 + (y - 10)^2 = 25$

127) $-4y = -x^2 + 32x - 256 - y^2$

128) $y^2 + x^2 = -24y - 231 - 20x$

129) $311 + y^2 + x^2 = -32y + 16x$

130) $x^2 + y^2 - 12x - 26y + 204 = 0$

131) $777 - 16x\sqrt{39} = -4x^2 - 4y^2 - 52y$

132) $0 = -y^2 + 8x - 29 - 14y - x^2$

133) $x^2 - 22x - 22y = -y^2 - 217$

134) $0 = -24y - y^2 - x^2 - 208 - 20x$

135) $x^2 + y^2 + 16x - 26y + 215 = 0$

136) $x^2 + y^2 + 32x - 20y + 352 = 0$

137) $x^2 + y^2 - 6x - 22y + 81 = 0$

138) $y^2 - 168 + x^2 = -2x + 4y$

139) $4y^2 - 76y + 4x^2 = -317 + 40x$

140) $-2x + x^2 + y^2 = -4y + 38$

141) $-156 - 4x + x^2 = -6y - y^2$

142) $202 + 26x + y^2 + 14y = -x^2$

143) $-12x + y^2 = -155 - 24y - x^2$

144) $x^2 + 131 + y^2 = 22y - 12x$

145) $y^2 - 17 = -x^2 + 16x$

146) $x^2 = -319 - 32y - y^2 - 16x$

147) $x^2 + y^2 + 1 = -14y + 8x$

148) $y^2 + 333 - 18x = -x^2 + 32y$

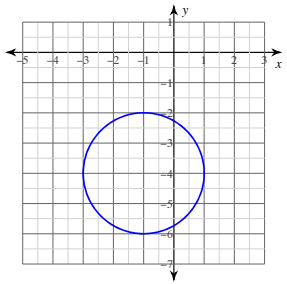
149) $79 - 20x + x^2 = 4y - y^2$

150) $-22x + 245 + y^2 - 24y + x^2 = 0$

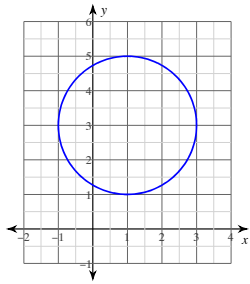
151) $y^2 + 82 + 10x = 22y - x^2$

152) $x^2 + y^2 - 32x - 26y + 416 = 0$

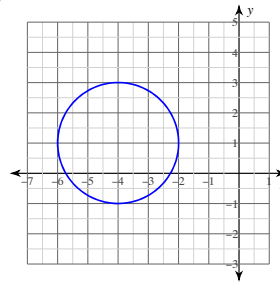
153)



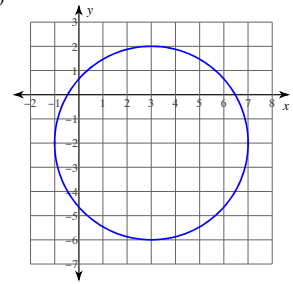
154)



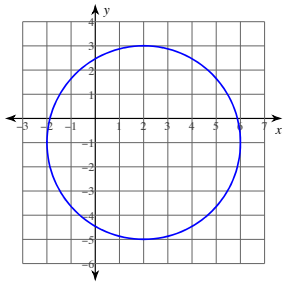
159)



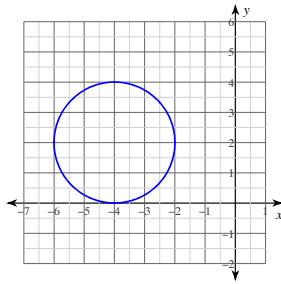
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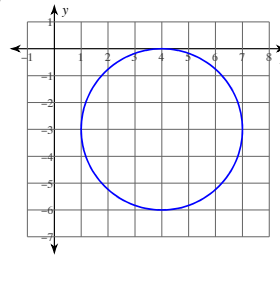
155)



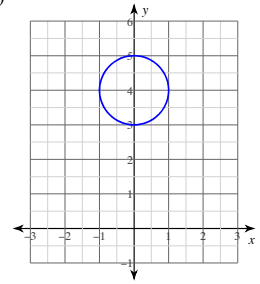
156)



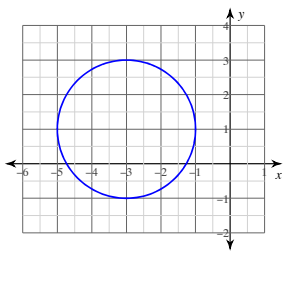
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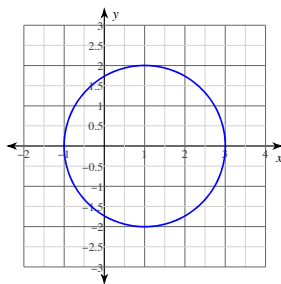
162)



157)

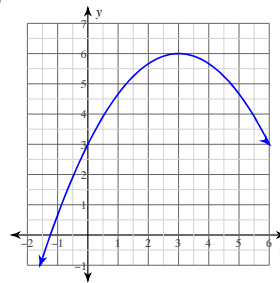


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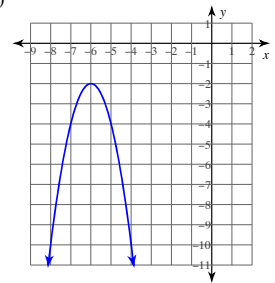


15.5 I can determine characteristics of parabolas from their equations and graphs

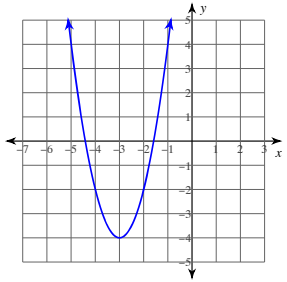
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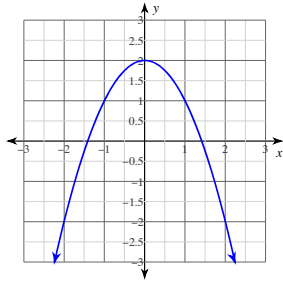
164)



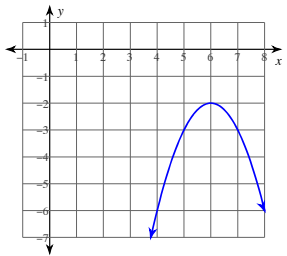
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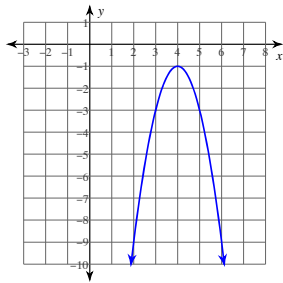
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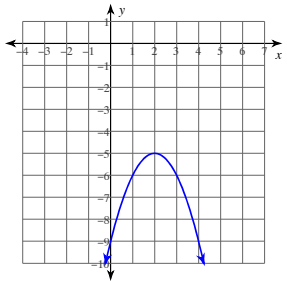
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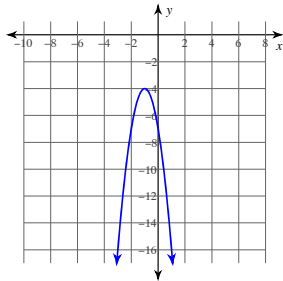
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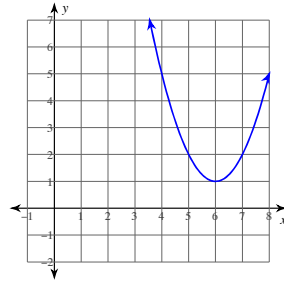
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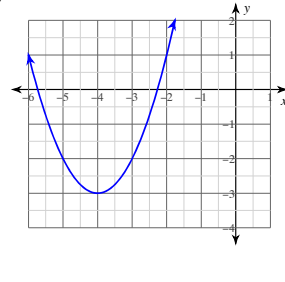
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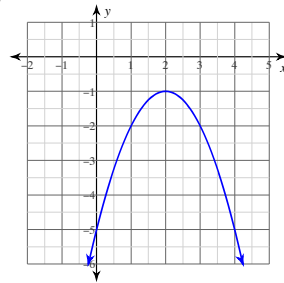
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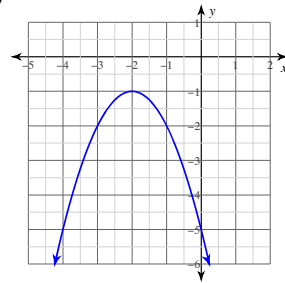
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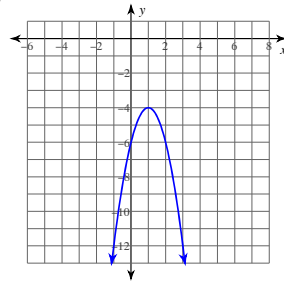
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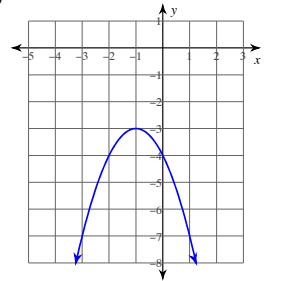
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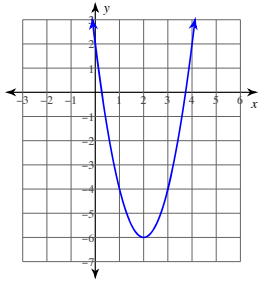
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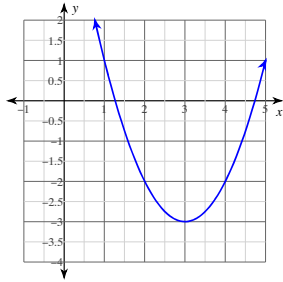
176)



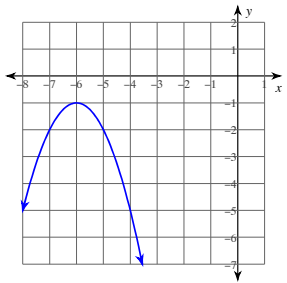
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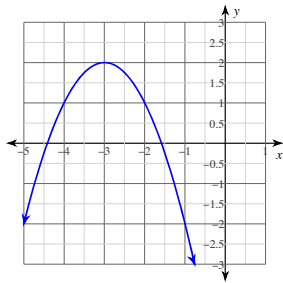
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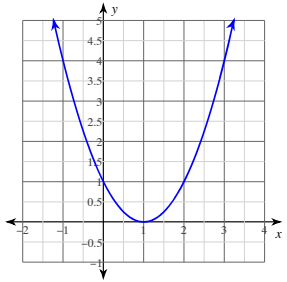
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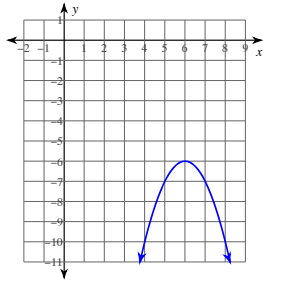
180)



181)



182)



183) $-4x^2 - 137 + y - 48x = 0$

184) $4x + y = -5 + 2x^2$

185) $4y - 11 - 6x = -x^2$

186) $\frac{1}{3}(y + 4) = (x - 4)^2$

187) $-2(y + 6) = x^2$

188) $2x^2 + 32x + y + 133 = 0$

189) $y = -15(x - 6)^2 - 5$

190) $y - 1 = (x + 7)^2$

191) $y = -(x - 6)(x - 4)$

192) $10x^2 + y = -89 - 60x$

193) $-28x + 94 = -y - 2x^2$

194) $106 + 20x = -y - x^2$

195) $y = (x + 7)(x + 1)$

196) $y - 2x^2 = -16x + 24$

197) $-1597 = -320x - y + 16x^2$

198) $-2x^2 + 36x = -y + 165$

199) $x^2 - 8x = -34 - 2y$

200) $x^2 + 4x + 2y + 4 = 0$

201) $-3x^2 + 12x + y - 4 = 0$

202) $x^2 = 18x - y - 78$

203) $y - 144x - 8x^2 = 655$

204) $y = 2x^2 + 28x + 108$

205) $54x + y + 3x^2 = -241$

206) $y + x^2 - 6x = -18$

207) $y = 4x^2 + 64x + 249$

208) $12x = -y + x^2 + 39$

209) $y = -(x + 8)^2 + 8$

210) $-(y + 10) = (x + 7)^2$

211) $-2(y + 1) = (x + 3)^2$

212) $2x^2 - 16x + y + 41 = 0$

15.6 I can Identify and write equations for circles from given characteristics and graphs

213) Center: $(-15, -9)$
Radius: 3

214) Center: $(16, 3)$
Radius: 2

215) Center: $(-4, -2)$
Radius: 9

216) Center: $(-1, -14)$
Radius: 2

217) Center: $(-5, 9)$
Radius: $\sqrt{66}$

218) Center: $(6, 16)$
Radius: 3

219) Center: $(11, -7)$
Radius: $4\sqrt{2}$

220) Center: $(5, -5)$
Radius: 5

221) Center: $(-13, 12)$
Radius: $\sqrt{15}$

222) Center: $(9, 4)$
Radius: 6

223) Center: $(12, 14)$
Circumference: 8π

224) Center: $(10, -7)$
Circumference: 18π

225) Center: $(-10, -12)$
Circumference: 6π

226) Center: $(0, 6)$
Circumference: 8π

227) Center: $(-2, -15)$
Circumference: $2\pi\sqrt{10}$

228) Center: $(14, 2)$
Circumference: 8π

229) Center: $(-14, 11)$
Circumference: 2π

230) Center: $(-11, 0)$
Circumference: $6\pi\sqrt{7}$

231) Center: $(2, -5)$
Circumference: 18π

233) Center: $(6, 10)$
Point on Circle: $(5, 10)$

235) Center: $(0, -11)$
Point on Circle: $(-6, -13)$

237) Center: $(2, -16)$
Point on Circle: $(4, -17)$

239) Center: $(9, 1)$
Point on Circle: $(1, -5)$

241) Center: $(5, -5)$
Point on Circle: $(-6, 3)$

232) Center: $(8, 5)$
Circumference: 12π

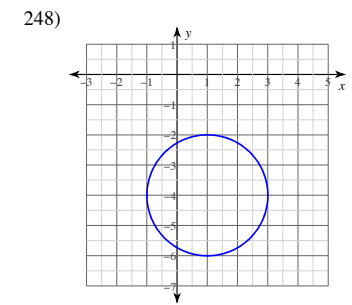
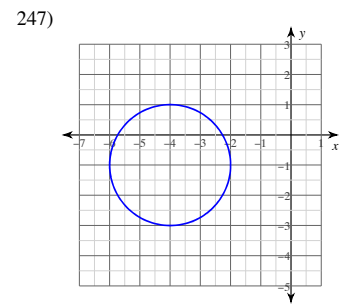
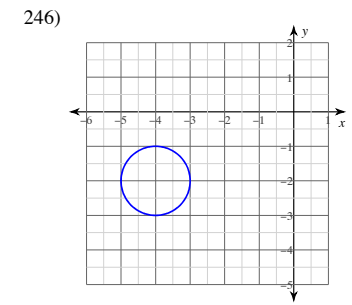
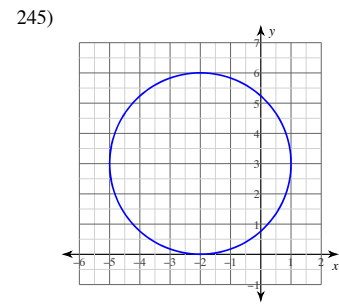
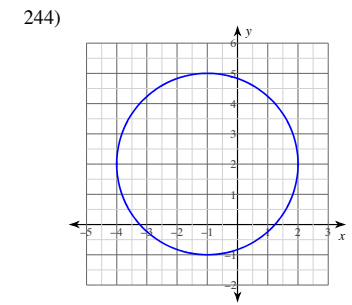
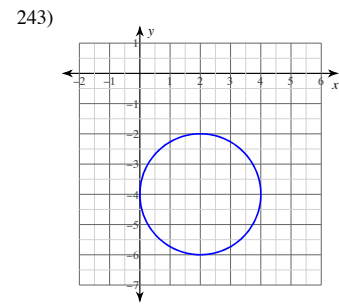
234) Center: $(4, 10)$
Point on Circle: $(-1, 5)$

236) Center: $(1, 4)$
Point on Circle: $(-12, -3)$

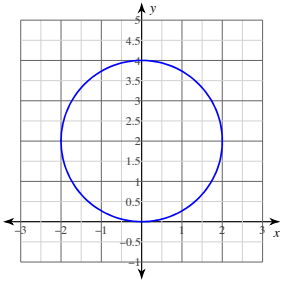
238) Center: $(-3, -10)$
Point on Circle: $(4, -14)$

240) Center: $(3, -4)$
Point on Circle: $(10, 4)$

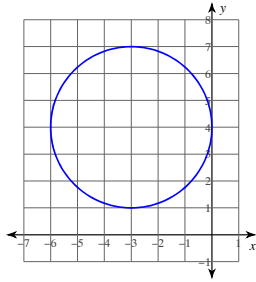
242) Center: $(2, 16)$
Point on Circle: $(1, 16)$



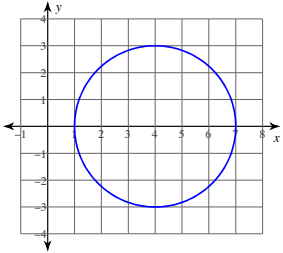
249)



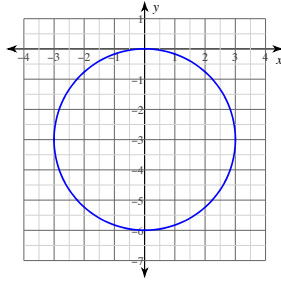
250)



251)



252)



15.7 I can identify and write equations for parabolas from given characteristics and graphs

253) Vertex: $(-6, 1)$, Focus: $(-6, \frac{3}{4})$

254) Vertex: $(4, -9)$, Focus: $(4, -\frac{17}{2})$

255) Vertex: $(9, -7)$, Focus: $(9, -\frac{197}{28})$

256) Vertex: $(-2, 10)$, Focus: $(-2, \frac{41}{4})$

257) Vertex: $(3, -6)$, Focus: $(3, -\frac{11}{2})$

258) Vertex: $(5, 8)$, Focus: $(5, \frac{31}{4})$

259) Vertex: $(-5, -8)$, Focus: $(-5, -\frac{65}{8})$

260) Vertex: $(4, -2)$, Focus: $(4, -\frac{17}{8})$

261) Vertex: $(1, 0)$, Focus: $(1, \frac{1}{16})$

262) Vertex: $(2, 4)$, Focus: $(2, \frac{17}{4})$

263) Vertex: $(-9, 6)$, Focus: $(-9, \frac{21}{4})$

264) Vertex: $(1, 7)$, Focus: $(1, \frac{27}{4})$

265) Vertex: $(-6, -7)$, Focus: $(-6, -\frac{307}{44})$

266) Vertex: $(9, 7)$, Focus: $(9, \frac{57}{8})$

267) Vertex: $(-3, -2)$, Focus: $(-3, -\frac{7}{4})$

268) Vertex: $(-9, 4)$, Focus: $(-9, \frac{31}{8})$

269) Opens up or down, and passes through $(-7, \frac{3}{2})$, $(-2, -6)$, and $(-8, 0)$

270) Opens up or down, and passes through $(-3, 1)$, $(-5, 1)$, and $(-4, 4)$

271) Opens up or down, and passes through $(4, -14)$, $(-1, -19)$, and $(2, -10)$

272) Opens up or down, and passes through $(4, -20)$, $(0, -4)$, and $(-3, -13)$

273) Opens up or down, and passes through $(0, 3)$, $(-3, 9)$, and $(2, 19)$

274) Opens up or down, and passes through $(3, 51)$, $(5, 3)$, and $(1, 195)$

275) Opens up or down, and passes through $(13, 12)$, $(8, -3)$, and $(11, 0)$

276) Opens up or down, and passes through $(-11, -4)$, $(-6, 1)$, and $(-7, 4)$

277) Opens up or down, and passes through $(-6, -1)$, $(-4, 3)$, and $(0, -13)$

278) Opens up or down, and passes through $(7, 26)$, $(13, 26)$, and $(14, 40)$

279) Opens up or down, and passes through $(-9, -2)$, $(-4, 43)$, and $(-7, -2)$

281) Opens up or down, and passes through $(10, -33)$, $(6, -1)$, and $(5, -3)$

283) Opens up or down, and passes through $(4, 15)$, $(9, 40)$, and $(5, 0)$

285) Vertex: $(5, 5)$, y-intercept: $-\frac{15}{2}$

287) Vertex: $(-9, 10)$, y-intercept: 91

289) Vertex: $(9, -2)$, y-intercept: 79

291) Vertex: $(-5, -3)$, y-intercept: -103

293) Vertex: $(-10, 6)$, y-intercept: -44

295) Vertex: $(6, -4)$, y-intercept: -616

297) Vertex: $(8, 8)$, y-intercept: 200

299) Vertex: $(-1, -5)$, y-intercept: -6

301) Opens up or down, Vertex: $(-8, 7)$, Passes through: $(-9, 6)$

280) Opens up or down, and passes through $(-4, 12)$, $(-5, 36)$, and $(-6, 76)$

282) Opens up or down, and passes through $(-5, 41)$, $(-12, 69)$, and $(-10, 21)$

284) Opens up or down, and passes through $(6, 20)$, $(4, 4)$, and $(5, 10)$

286) Vertex: $(-2, -6)$, y-intercept: 2

288) Vertex: $(-5, -5)$, y-intercept: 270

290) Vertex: $(5, 1)$, y-intercept: 51

292) Vertex: $(1, -8)$, y-intercept: -10

294) Vertex: $(-9, -4)$, y-intercept: -247

296) Vertex: $(-6, 6)$, y-intercept: 78

298) Vertex: $(-1, -4)$, y-intercept: $-\frac{13}{3}$

300) Vertex: $(-3, 4)$, y-intercept: 13

302) Opens up or down, Vertex: $(6, -3)$, Passes through: $(8, -\frac{35}{13})$

303) Opens up or down, Vertex: $(-5, 4)$, Passes through: $(-6, 5)$

304) Opens up or down, Vertex: $(6, 6)$, Passes through: $(7, 11)$

305) Opens up or down, Vertex: $(9, -3)$, Passes through: $(10, -2)$

306) Opens up or down, Vertex: $(10, 10)$, Passes through: $(9, 12)$

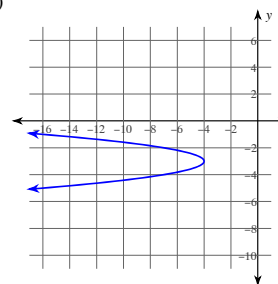
307) Opens up or down, Vertex: $(7, -9)$, Passes through: $(4, -36)$

308) Opens up or down, Vertex: $(-1, 5)$, Passes through: $(-3, 9)$

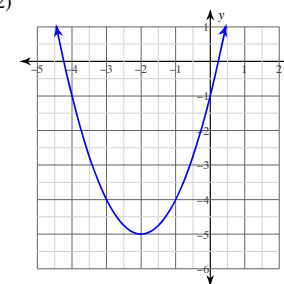
309) Opens up or down, Vertex: $(0, 7)$, Passes through: $(-3, \frac{19}{4})$

310) Opens up or down, Vertex: $(2, 3)$, Passes through: $(4, -9)$

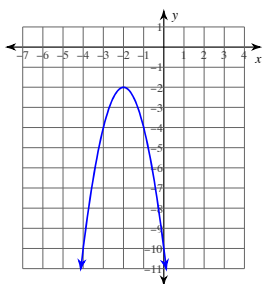
311)



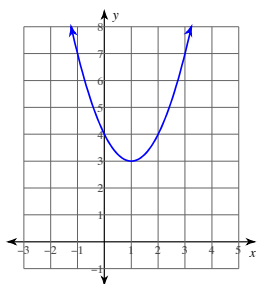
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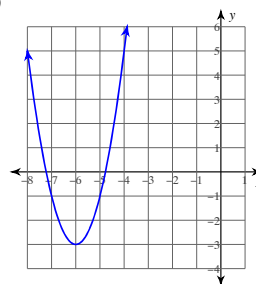
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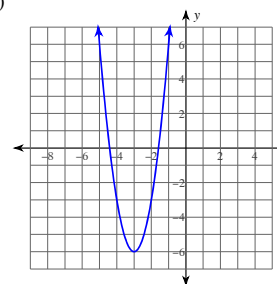
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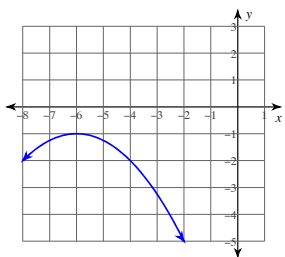
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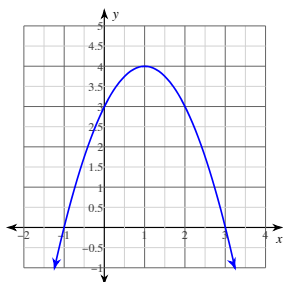
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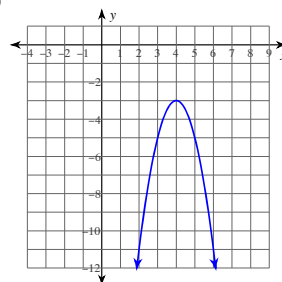
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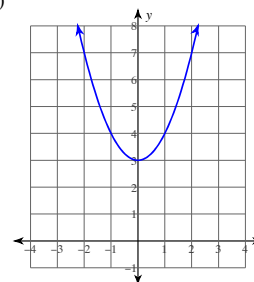
316)



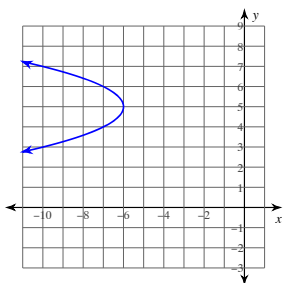
321)



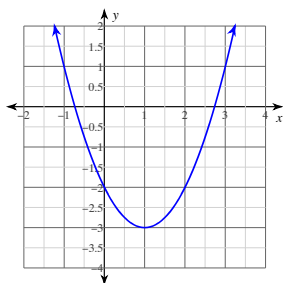
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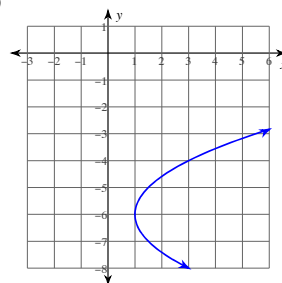
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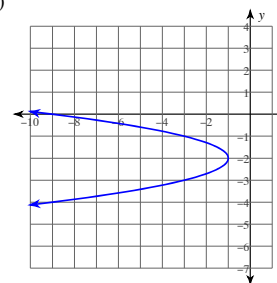
318)



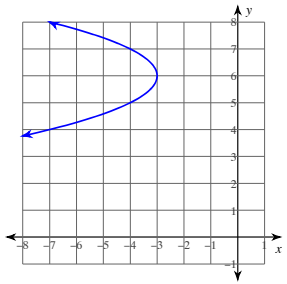
323)



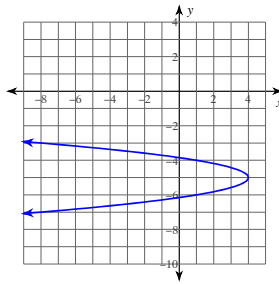
324)



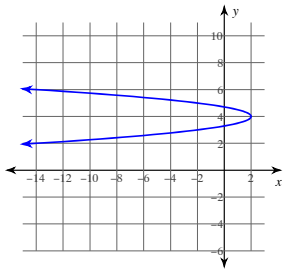
325)



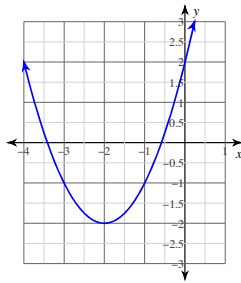
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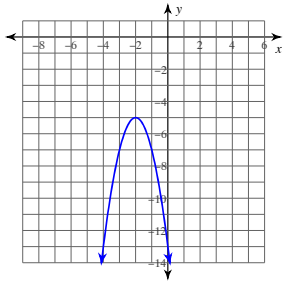
327)



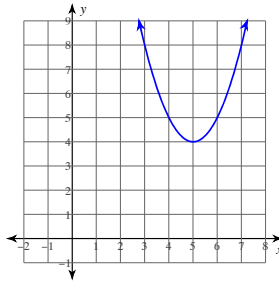
328)



329)



330)



15.8 I can identify and write equations for ellipses from given characteristics and graphs

331) Vertices: $(8 + \sqrt{190}, 1), (8 - \sqrt{190}, 1)$
 Foci: $(8 + 2\sqrt{15}, 1), (8 - 2\sqrt{15}, 1)$

332) Vertices: $(16, -9), (-2, -9)$
 Foci: $(7 + 4\sqrt{2}, -9), (7 - 4\sqrt{2}, -9)$

333) Vertices: $(\frac{45}{2}, -\frac{1}{2}), (-\frac{11}{2}, -\frac{1}{2})$
 Foci: $(\frac{12\sqrt{5} + 17}{2}, -\frac{1}{2}), (\frac{-12\sqrt{5} + 17}{2}, -\frac{1}{2})$

334) Vertices: $(-2, 5), (-2, -5)$
 Foci: $(-2, 3), (-2, -3)$

335) Vertices: $(16, -8), (-10, -8)$
 Foci: $(3 + 2\sqrt{30}, -8), (3 - 2\sqrt{30}, -8)$

336) Vertices: $(0, -2), (-18, -2)$
 Foci: $(-9 + 3\sqrt{5}, -2), (-9 - 3\sqrt{5}, -2)$

337) Vertices: $(18, -5), (-2, -5)$
 Foci: $(14, -5), (2, -5)$

338) Vertices: $(13, 3), (-7, 3)$
 Foci: $(3 + 2\sqrt{21}, 3), (3 - 2\sqrt{21}, 3)$

339) Vertices: $(\frac{9}{2}, 6), (-\frac{27}{2}, 6)$
 Foci: $(\frac{12\sqrt{2} - 9}{2}, 6), (\frac{-12\sqrt{2} - 9}{2}, 6)$

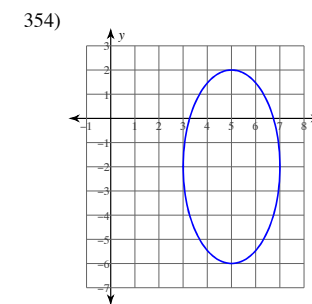
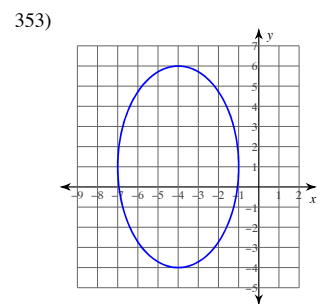
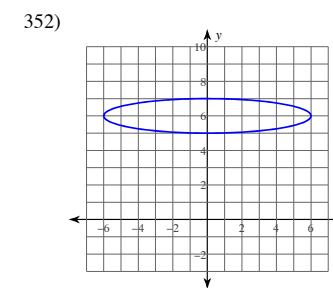
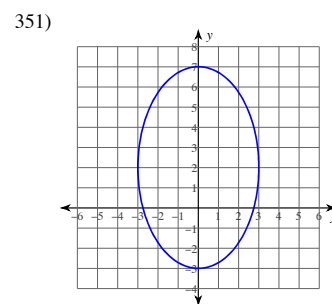
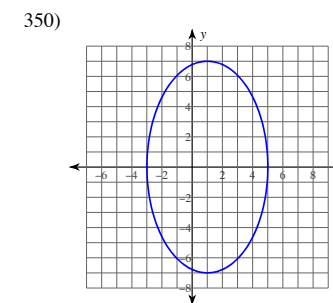
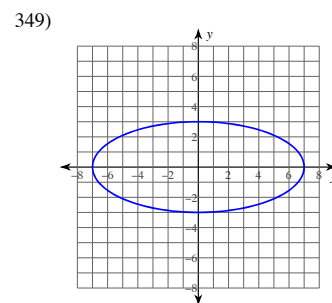
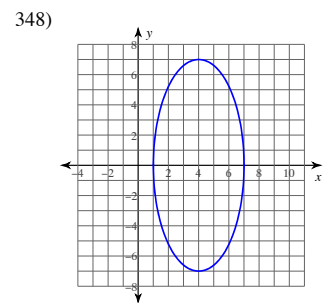
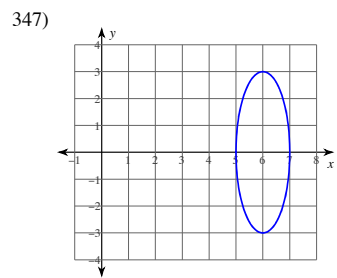
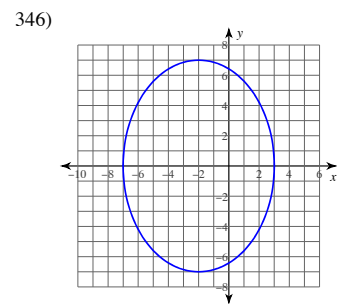
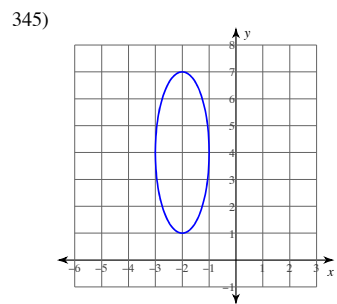
340) Vertices: $(5, 10), (-7, 10)$
 Foci: $(-1 + 3\sqrt{3}, 10), (-1 - 3\sqrt{3}, 10)$

341) Vertices: $(-10, 12), (-10, 0)$
 Foci: $(-10, 6 + \sqrt{11}), (-10, 6 - \sqrt{11})$

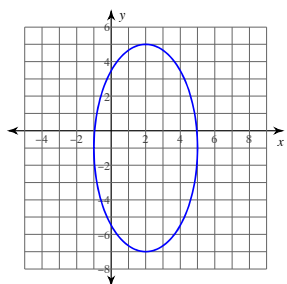
342) Vertices: $(6, -2), (-16, -2)$
 Foci: $(-5 + 4\sqrt{7}, -2), (-5 - 4\sqrt{7}, -2)$

343) Vertices: $(5, 9), (-15, 9)$
 Foci: $(-5 + 3\sqrt{11}, 9), (-5 - 3\sqrt{11}, 9)$

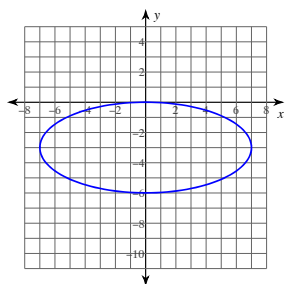
344) Vertices: $(-2 + \sqrt{15}, -10), (-2 - \sqrt{15}, -10)$
 Foci: $(-2 + \sqrt{5}, -10), (-2 - \sqrt{5}, -10)$



355)



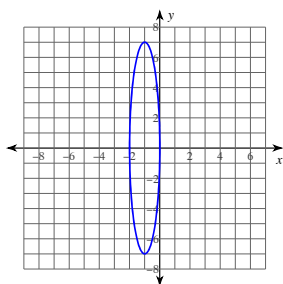
357)



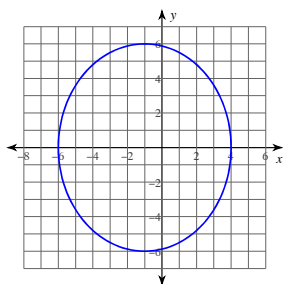
359) Center: $(6, 6)$
 Focus: $(6 + 2\sqrt{7}, 6)$
 Height: 12

361) Center: $(10, 0)$
 Focus: $(10 + \sqrt{95}, 0)$
 Height: 14

356)



358)



360) Center: $(1, -6)$
 Focus: $(1 - 4\sqrt{7}, -6)$
 Height: 6

362) Center: $(-2, 0)$
 Focus: $(-2, -\sqrt{10})$
 Width: $12\sqrt{5}$

363) Center: $(6, -3)$
 Focus: $(6 + \sqrt{65}, -3)$
 Height: 8

365) Center: $(2, 3)$
 Focus: $(2 + \sqrt{57}, 3)$
 Height: 16

367) Center: $(-7, -9)$
 Focus: $(-7 - \sqrt{57}, -9)$
 Width: 22

369) Center: $(9, 3)$
 Focus: $(9 - 2\sqrt{30}, 3)$
 Width: $2\sqrt{195}$

371) Center: $(9, -6)$
 Focus: $(9 + 5\sqrt{5}, -6)$
 Height: $10\sqrt{3}$

364) Center: $(10, 9)$
 Focus: $(10 + 3\sqrt{17}, 9)$
 Width: 26

366) Center: $(7, 8)$
 Focus: $(7 - \sqrt{17}, 8)$
 Width: 18

368) Center: $(-8, 8)$
 Focus: $(-8, 8 - 4\sqrt{3})$
 Height: 16

370) Center: $(5, 6)$
 Focus: $(5, 6 + 6\sqrt{3})$
 Width: 12

372) Center: $(5, -9)$
 Focus: $(5, -9 + \sqrt{15})$
 Height: 16

15.9 I can identify and write equations for hyperbolas from given characteristics and graphs

373) Vertices: $(-2, 14), (-2, -6)$
 Endpoints of Conjugate Axis: $(5, 4)$
 $(-9, 4)$

374) Vertices: $(-9, 9), (-9, -5)$
 Endpoints of Conjugate Axis: $(6, 2)$
 $(-24, 2)$

375) Vertices: $\left(\frac{15}{2}, -4\right), \left(\frac{15}{2}, -14\right)$
 Endpoints of Conjugate Axis: $\left(\frac{31}{2}, -9\right)$
 $\left(-\frac{1}{2}, -9\right)$

377) Vertices: $(-6, 12), (-6, -10)$
 Endpoints of Conjugate Axis: $(3, 1)$
 $(-15, 1)$

379) Vertices: $(7, 23), (7, -3)$
 Endpoints of Conjugate Axis: $(17, 10)$
 $(-3, 10)$

381) Vertices: $(2, 11), (2, 3)$
 Endpoints of Conjugate Axis: $(13, 7)$
 $(-9, 7)$

383) Vertices: $(-10, -4), (-10, -10)$
 Endpoints of Conjugate Axis: $(2, -7)$
 $(-22, -7)$

376) Vertices: $(3, 0), (3, -8)$
 Endpoints of Conjugate Axis: $(15, -4)$
 $(-9, -4)$

378) Vertices: $\left(\frac{17}{2}, \frac{35}{2}\right), \left(\frac{17}{2}, \frac{3}{2}\right)$
 Endpoints of Conjugate Axis: $\left(\frac{29}{2}, \frac{19}{2}\right)$
 $\left(\frac{5}{2}, \frac{19}{2}\right)$

380) Vertices: $(-10, 17), (-10, 3)$
 Endpoints of Conjugate Axis: $(-5, 10)$
 $(-15, 10)$

382) Vertices: $(3, 9), (3, -13)$
 Endpoints of Conjugate Axis: $(7, -2)$
 $(-1, -2)$

384) Vertices: $(3, 16), (3, 0)$
 Endpoints of Conjugate Axis: $(7, 8)$
 $(-1, 8)$

385) Vertices: $(7, 1), (7, -3)$
 Endpoints of Conjugate Axis: $(18, -1)$
 $(-4, -1)$

387) Vertices: $(0, 1), (0, -7)$
 Foci: $(0, -3 + 2\sqrt{13}), (0, -3 - 2\sqrt{13})$

389) Vertices: $(0, 18), (0, 0)$
 Foci: $(0, 24), (0, -6)$

391) Vertices: $(-4, 18), (-4, -6)$
 Foci: $(-4, 6 + 12\sqrt{2}), (-4, 6 - 12\sqrt{2})$

393) Vertices: $(8, -1), (8, -19)$
 Foci: $(8, -10 + \sqrt{181}), (8, -10 - \sqrt{181})$

395) Vertices: $(-8, 15), (-8, -9)$
 Foci: $(-8, 3 + 2\sqrt{61}), (-8, 3 - 2\sqrt{61})$

397) Vertices: $(4, 10), (4, -10)$
 Foci: $(4, 5\sqrt{5}), (4, -5\sqrt{5})$

386) Vertices: $(-2, 1), (-2, -11)$
 Endpoints of Conjugate Axis: $(5, -5)$
 $(-9, -5)$

388) Vertices: $\left(\frac{1}{2}, \frac{19}{2}\right), \left(\frac{1}{2}, -\frac{9}{2}\right)$
 Foci: $\left(\frac{1}{2}, \frac{14\sqrt{2} + 5}{2}\right), \left(\frac{1}{2}, \frac{-14\sqrt{2} + 5}{2}\right)$

390) Vertices: $(4, -2), (4, -16)$
 Foci: $(4, -9 + \sqrt{65}), (4, -9 - \sqrt{65})$

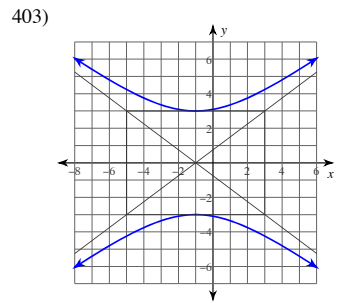
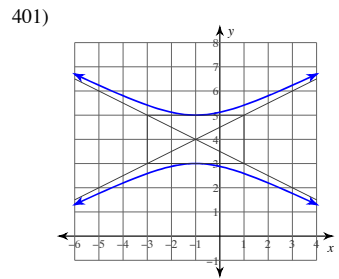
392) Vertices: $(4, 8), (4, -16)$
 Foci: $(4, 9), (4, -17)$

394) Vertices: $(9, 12), (9, -6)$
 Foci: $(9, 3 + 3\sqrt{10}), (9, 3 - 3\sqrt{10})$

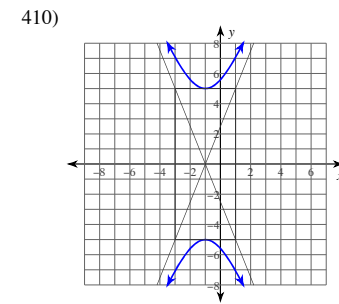
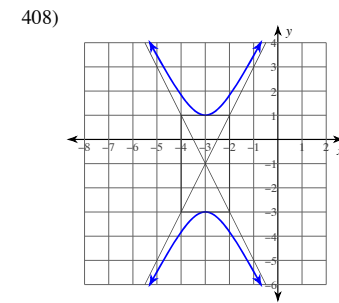
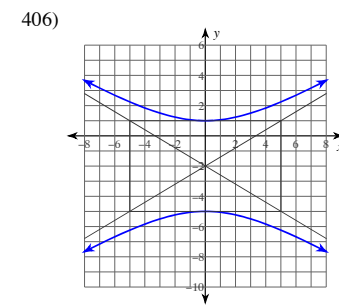
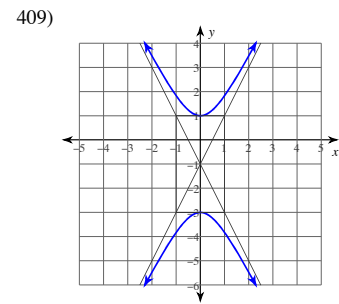
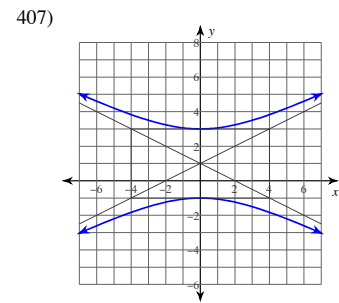
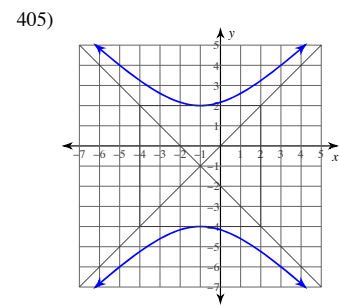
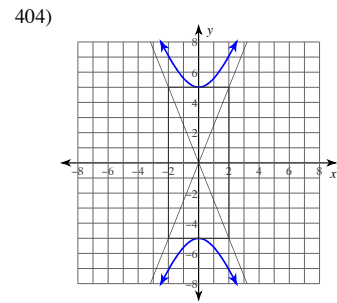
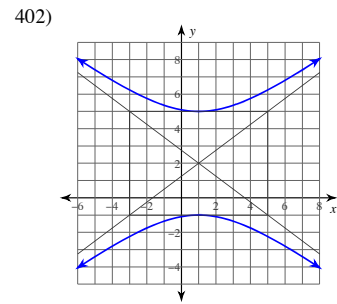
396) Vertices: $(8, 12), (8, -14)$
 Foci: $(8, -1 + \sqrt{290}), (8, -1 - \sqrt{290})$

398) Vertices: $(-5, -3), (-5, -9)$
 Foci: $(-5, -1), (-5, -11)$

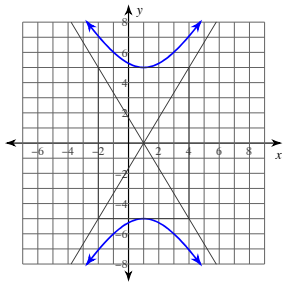
399) Vertices: $(-5, 11), (-5, -1)$
 Foci: $(-5, 5 + 3\sqrt{5}), (-5, 5 - 3\sqrt{5})$



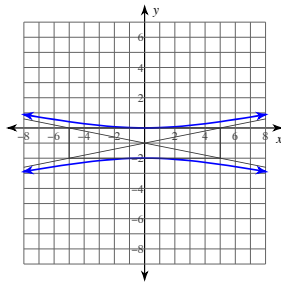
400) Vertices: $(-1, 16), (-1, 2)$
 Foci: $(-1, 9 + 5\sqrt{2}), (-1, 9 - 5\sqrt{2})$



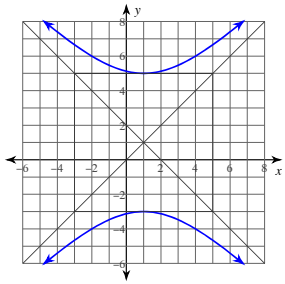
411)



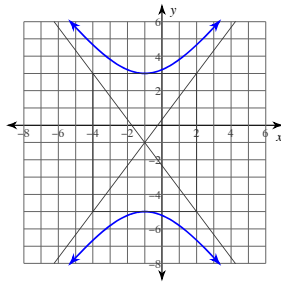
412)



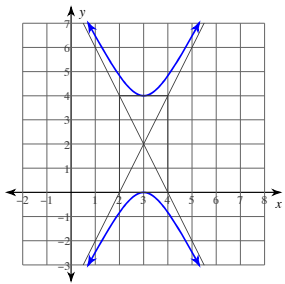
413)



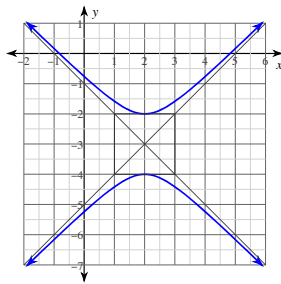
414)



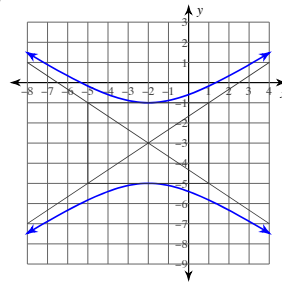
415)



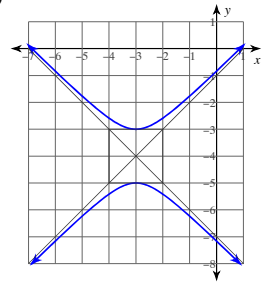
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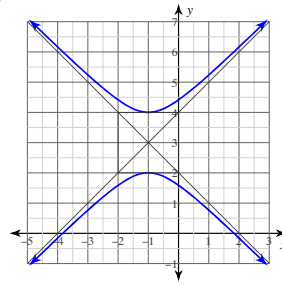
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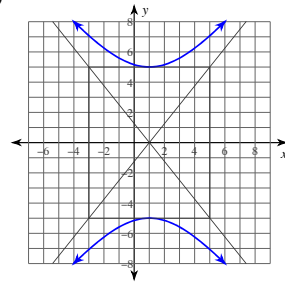
418)



419)



420)



421) Center at $(10, -10)$
 Focus at $(10, -10 + 5\sqrt{10})$
 Eccentricity = $\frac{\sqrt{15}}{3}$

422) Center at $(7, 7)$
 Focus at $(7, 7 - \sqrt{181})$
 Eccentricity = $\frac{\sqrt{181}}{9}$

423) Center at $(-6, 0)$
 Focus at $(-6, 2\sqrt{85})$
 Eccentricity = $\frac{\sqrt{85}}{7}$

425) Center at $(-1, -9)$
 Focus at $(-1, -9 + \sqrt{5})$
 Eccentricity = $\sqrt{5}$

427) Center at $(-2, 0)$
 Focus at $(-2, \sqrt{185})$
 Eccentricity = $\frac{\sqrt{185}}{11}$

429) Center at $(-9, -2)$
 Focus at $(-9, -2 - 4\sqrt{13})$
 Eccentricity = $\frac{\sqrt{13}}{3}$

431) Center at $(3, -6)$
 Focus at $(3, -6 + 2\sqrt{10})$
 Eccentricity = $\sqrt{10}$

424) Center at $(-10, -4)$
 Focus at $(-10, -4 - 2\sqrt{85})$
 Eccentricity = $\frac{\sqrt{85}}{7}$

426) Center at $(7, -3)$
 Focus at $(7, -3 + 3\sqrt{13})$
 Eccentricity = $\frac{\sqrt{13}}{2}$

428) Center at $(0, 7)$
 Focus at $(0, 7 - 7\sqrt{5})$
 Eccentricity = $\frac{7\sqrt{23}}{23}$

430) Center at $(-9, 10)$
 Focus at $(-9, 10 - \sqrt{149})$
 Eccentricity = $\frac{\sqrt{149}}{10}$

432) Center at $(-7, 1)$
 Focus at $(-7, 1 - \sqrt{145})$
 Eccentricity = $\frac{\sqrt{145}}{8}$

433) Center at $(-1, 3)$
 Focus at $(-1, 3 - 5\sqrt{10})$
 Eccentricity = $\frac{5\sqrt{10}}{13}$

435) Center at $(-1, 1)$
 Focus at $(-1, 1 + \sqrt{89})$
 Eccentricity = $\frac{\sqrt{89}}{5}$

437) Center at $(-10, 6)$
 Focus at $(-10, 6 - \sqrt{29})$
 Eccentricity = $\frac{\sqrt{29}}{2}$

439) Center at $(-10, -4)$
 Focus at $(-10, -4 - \sqrt{145})$
 Eccentricity = $\frac{\sqrt{754}}{26}$

434) Center at $(4, 4)$
 Focus at $(4, 4 - 5\sqrt{2})$
 Eccentricity = $\sqrt{2}$

436) Center at $(-6, 9)$
 Focus at $(-6, 9 + 3\sqrt{2})$
 Eccentricity = $\sqrt{2}$

438) Center at $(-\frac{1}{2}, 10)$
 Focus at $(-\frac{1}{2}, 10 + \sqrt{85})$
 Eccentricity = $\frac{\sqrt{85}}{6}$

440) Center at $(-5, -8)$
 Focus at $(-5, -8 - 7\sqrt{2})$
 Eccentricity = $\sqrt{2}$

15.10 I can identify Conic sections and their properties from their equations in standard form.

441) $\frac{x^2}{4} - \frac{y^2}{25} = 1$

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

443) $x = -2(y - 2)^2 + 2$

444) $(x + 4)^2 + (y - 3)^2 = 7$

445) $(x - 4)^2 + (y - 4)^2 = 1$

446) $(x + 4)^2 + (y - 1)^2 = 9$

447) $\frac{y^2}{15} - \frac{x^2}{20} = 1$

448) $x = -2(y + 1)^2 - 6$

449) $\frac{(x - 2)^2}{25} + \frac{(y + 1)^2}{16} = 1$

450) $\frac{(x + 3)^2}{9} + \frac{y^2}{49} = 1$

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

452) $\frac{y^2}{25} - (x + 1)^2 = 1$

453) $\frac{y^2}{25} - \frac{(x + 1)^2}{5} = 1$

454) $x = \frac{1}{3}(y + 4)^2 + 6$

455) $(x + 3)^2 + (y + 3)^2 = 4$

456) $\frac{(x - 4)^2}{9} + \frac{(y - 2)^2}{16} = 1$

457) $(x + 2)^2 + (y + 4)^2 = 7$

458) $\frac{x^2}{9} + \frac{(y + 3)^2}{4} = 1$

459) $\frac{(x - 1)^2}{4} + \left(y + \frac{9}{2}\right)^2 = 1$

460) $y = -2(x - 4)^2 - 6$

461) $\frac{(x + 1)^2}{4} + \frac{(y + 4)^2}{9} = 1$

462) $\frac{(x - 1)^2}{16} - \frac{(y + 1)^2}{9} = 1$

$$463) \frac{(x+2)^2}{4} + \frac{y^2}{49} = 1$$

$$465) x = -(y+3)^2 + 1$$

$$467) (x-3)^2 + y^2 = 4$$

$$469) (x-2)^2 + (y+4)^2 = 4$$

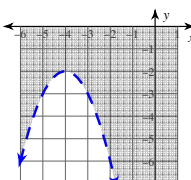
$$464) x^2 + y^2 = 44$$

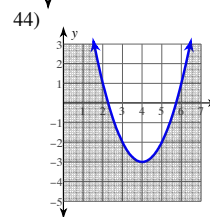
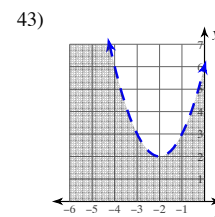
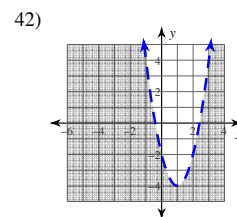
$$466) x^2 + (y+4)^2 = 6$$

$$468) x = \frac{6}{7}(y-2)^2 + 3$$

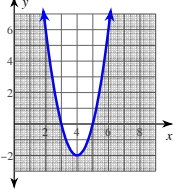
$$470) x = -(y-6)^2 + 5$$

Answers to Conics (ID: 1)

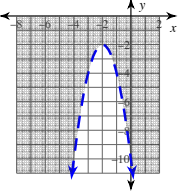
- 1) $\{-6, -8\}$
- 2) $\{-1, -11\}$
- 3) $\{-8 + 4\sqrt{3}, -8 - 4\sqrt{3}\}$
- 4) $\{2, -22\}$
- 5) $\{2, -12\}$
- 6) $\{11, 3\}$
- 7) $\{9 + \sqrt{3}, 9 - \sqrt{3}\}$
- 8) $\{7, -11\}$
- 9) $\left\{\frac{-2 + \sqrt{46}}{2}, \frac{-2 - \sqrt{46}}{2}\right\}$
- 10) $\{-2 + \sqrt{30}, -2 - \sqrt{30}\}$
- 11) $\{1, -5\}$
- 12) $\{5, -3\}$
- 13) $\{-2, -8\}$
- 14) $\left\{\frac{-7 + \sqrt{14}}{7}, \frac{-7 - \sqrt{14}}{7}\right\}$
- 15) $\left\{\frac{-5 + \sqrt{230}}{5}, \frac{-5 - \sqrt{230}}{5}\right\}$
- 16) $\left\{\frac{10 + \sqrt{105}}{5}, \frac{10 - \sqrt{105}}{5}\right\}$
- 17) $\left\{\frac{-9 + \sqrt{2461}}{14}, \frac{-9 - \sqrt{2461}}{14}\right\}$
- 18) $\left\{\frac{16}{5}, -1\right\}$
- 19) $\left\{\frac{29}{9}, -1\right\}$
- 20) $\left\{2, -\frac{2}{3}\right\}$
- 21) $\left\{\frac{8 + \sqrt{614}}{10}, \frac{8 - \sqrt{614}}{10}\right\}$
- 22) $\left\{\frac{1}{2}, -1\right\}$
- 23) $\left\{\frac{-13 + \sqrt{61}}{6}, \frac{-13 - \sqrt{61}}{6}\right\}$
- 24) $\left\{\frac{-5 + \sqrt{1417}}{12}, \frac{-5 - \sqrt{1417}}{12}\right\}$
- 25) $\{-3 + i\sqrt{19}, -3 - i\sqrt{19}\}$
- 26) $\left\{\frac{-3 + i\sqrt{69}}{3}, \frac{-3 - i\sqrt{69}}{3}\right\}$
- 27) $\{1 + \sqrt{7}, 1 - \sqrt{7}\}$
- 28) $\{2, -4\}$
- 29) $\left\{\frac{2+i}{2}, \frac{2-i}{2}\right\}$
- 30) $\left\{\frac{-3 + i\sqrt{77}}{3}, \frac{-3 - i\sqrt{77}}{3}\right\}$
- 31) $\{4, -2\}$
- 32) $\{-4 + i\sqrt{15}, -4 - i\sqrt{15}\}$
- 33) $\left\{\frac{15 + 7\sqrt{5}}{2}, \frac{15 - 7\sqrt{5}}{2}\right\}$
- 34) $\left\{\frac{11 + 3i\sqrt{3}}{2}, \frac{11 - 3i\sqrt{3}}{2}\right\}$
- 35) $\left\{\frac{3 + i\sqrt{287}}{2}, \frac{3 - i\sqrt{287}}{2}\right\}$
- 36) $\left\{\frac{12}{5}, -\frac{5}{2}\right\}$
- 37) $\{3, -8\}$
- 38) $\{-2, -11\}$
- 39) $\left\{\frac{2 + i\sqrt{69}}{3}, \frac{2 - i\sqrt{69}}{3}\right\}$
- 40) $\left\{\frac{-17 + i\sqrt{2311}}{20}, \frac{-17 - i\sqrt{2311}}{20}\right\}$
- 41) 



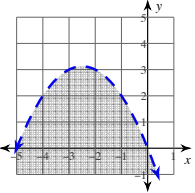
45)



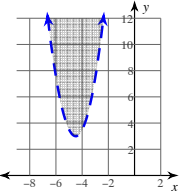
48)



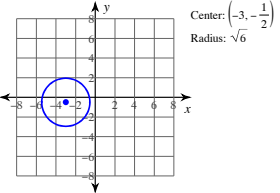
51)



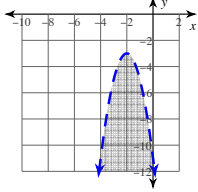
54)



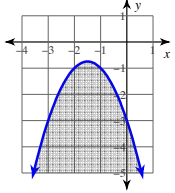
57)



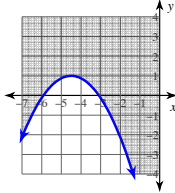
46)



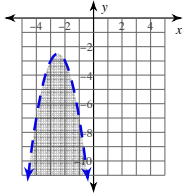
49)



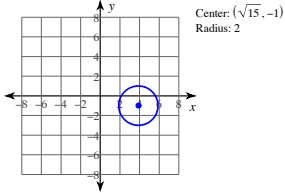
52)



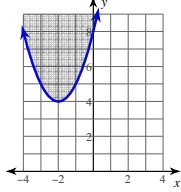
55)



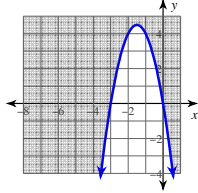
58)



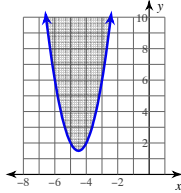
47)



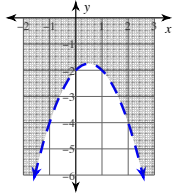
50)



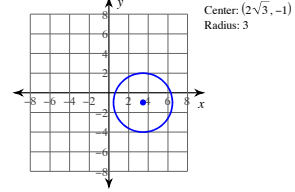
53)



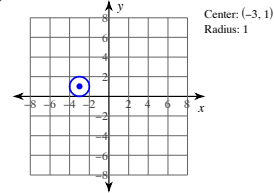
56)



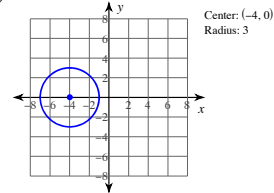
59)



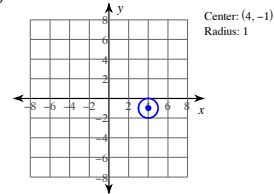
61)



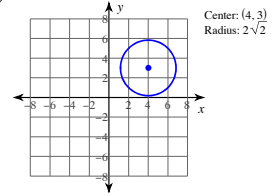
63)



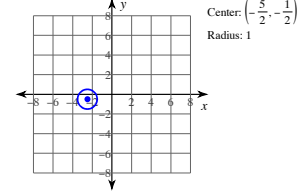
65)



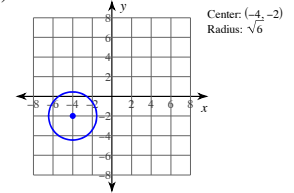
67)



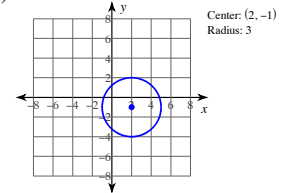
60)



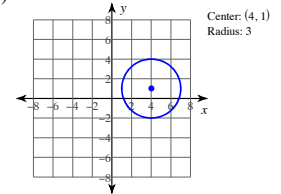
62)



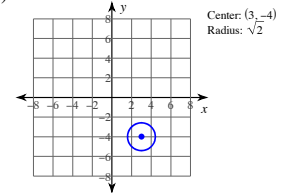
64)



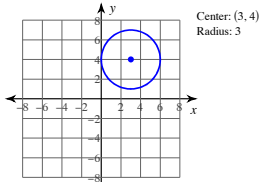
66)



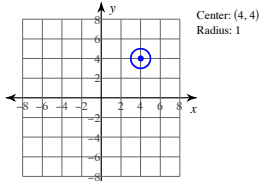
68)



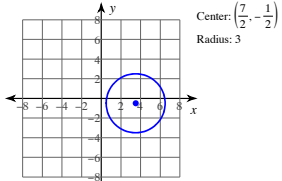
69)



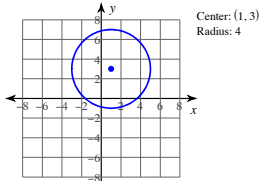
71)



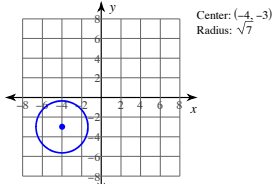
73)



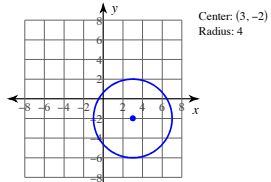
75)



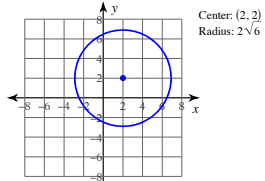
77)



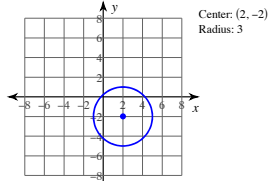
70)



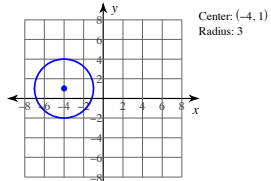
72)



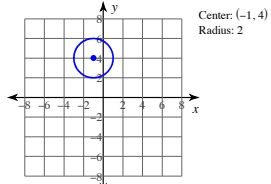
74)



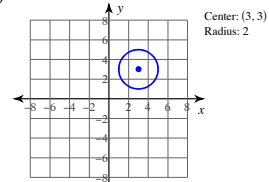
76)



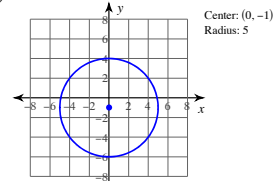
78)



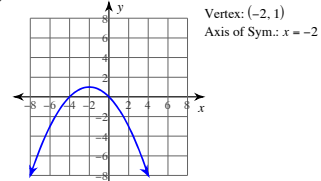
79)



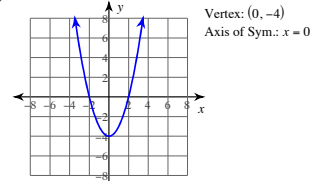
81)



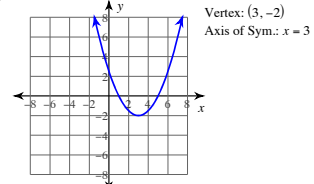
83)



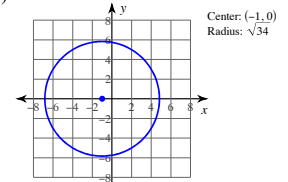
85)



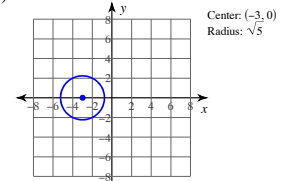
87)



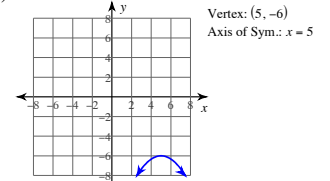
80)



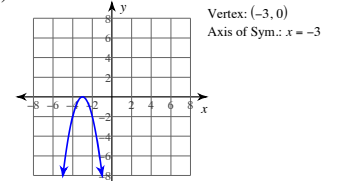
82)



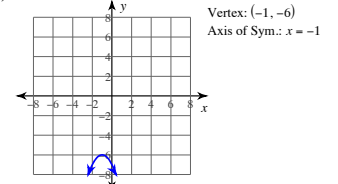
84)



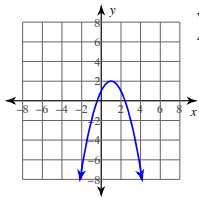
86)



88)

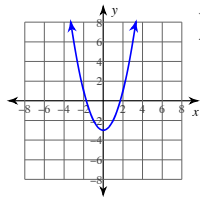


89)



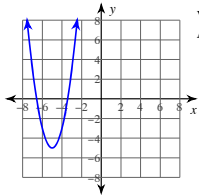
Vertex: $(1, 2)$
Axis of Sym.: $x = 1$

90)



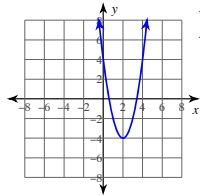
Vertex: $(0, -3)$
Axis of Sym.: $x = 0$

91)



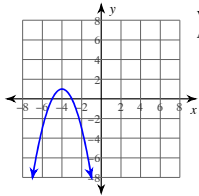
Vertex: $(-5, -5)$
Axis of Sym.: $x = -5$

92)



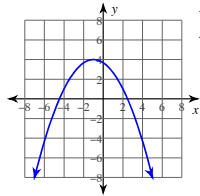
Vertex: $(2, -4)$
Axis of Sym.: $x = 2$

93)



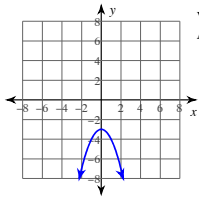
Vertex: $(-4, 1)$
Axis of Sym.: $x = -4$

94)



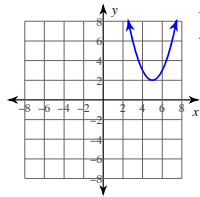
Vertex: $(-1, 4)$
Axis of Sym.: $x = -1$

95)



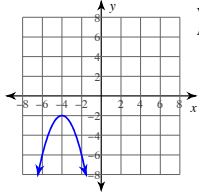
Vertex: $(0, -3)$
Axis of Sym.: $x = 0$

96)



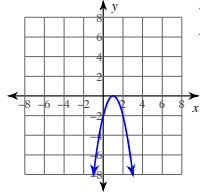
Vertex: $(5, 2)$
Axis of Sym.: $x = 5$

97)



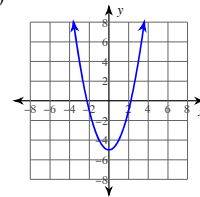
Vertex: $(-4, -2)$
Axis of Sym.: $x = -4$

98)



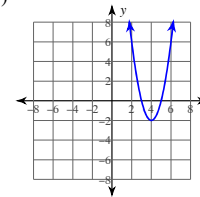
Vertex: $(1, 0)$
Axis of Sym.: $x = 1$

99)



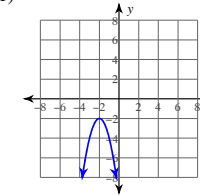
Vertex: $(0, -5)$
Axis of Sym.: $x = 0$

100)



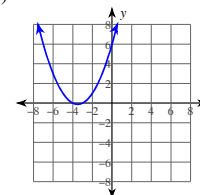
Vertex: $(4, -2)$
Axis of Sym.: $x = 4$

101)



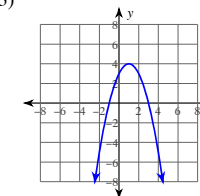
Vertex: $(-2, -2)$
Axis of Sym.: $x = -2$

102)



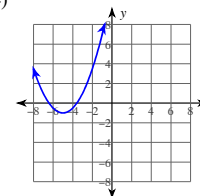
Vertex: $(-\frac{7}{2}, -\frac{1}{8})$
Axis of Sym.: $x = -\frac{7}{2}$

103)



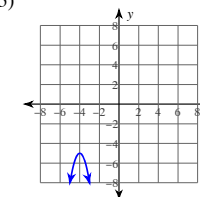
Vertex: $(1, 4)$
Axis of Sym.: $x = 1$

104)



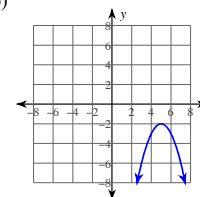
Vertex: $(-5, -1)$
Axis of Sym.: $x = -5$

105)



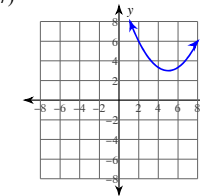
Vertex: $(-4, -5)$
Axis of Sym.: $x = -4$

106)



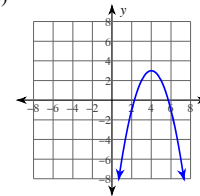
Vertex: $(5, -2)$
Axis of Sym.: $x = 5$

107)



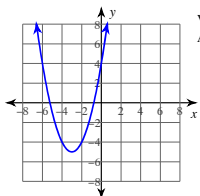
Vertex: $(5, 3)$
Axis of Sym.: $x = 5$

108)



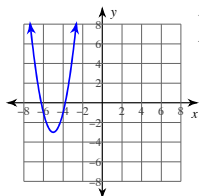
Vertex: $(4, 3)$
Axis of Sym.: $x = 4$

109)



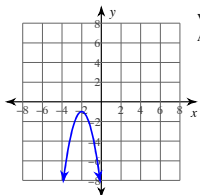
Vertex: $(-3, -5)$
Axis of Sym.: $x = -3$

110)



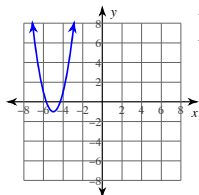
Vertex: $(-5, -3)$
Axis of Sym.: $x = -5$

111)



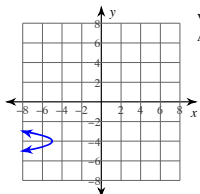
Vertex: $(-2, -1)$
Axis of Sym.: $x = -2$

112)



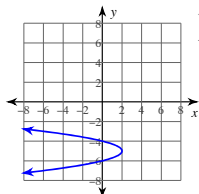
Vertex: $(-5, -1)$
Axis of Sym.: $x = -5$

113)



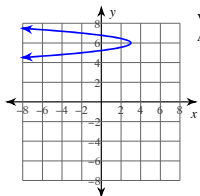
Vertex: $(-5, -4)$
Axis of Sym.: $y = -4$

114)



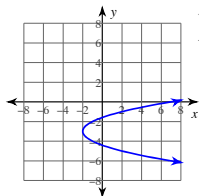
Vertex: $(2, -5)$
Axis of Sym.: $y = -5$

115)



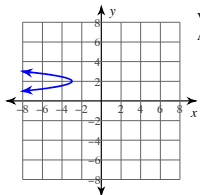
Vertex: $(3, 6)$
Axis of Sym.: $y = 6$

116)



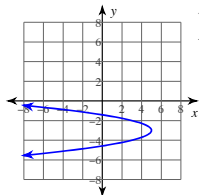
Vertex: $(-2, -3)$
Axis of Sym.: $y = -3$

117)



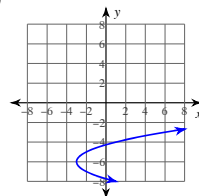
Vertex: $(-3, 2)$
Axis of Sym.: $y = 2$

118)



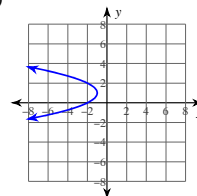
Vertex: $(5, -3)$
Axis of Sym.: $y = -3$

119)



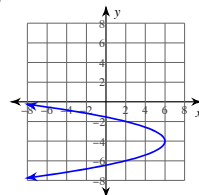
Vertex: $(-3, -6)$
Axis of Sym.: $y = -6$

120)



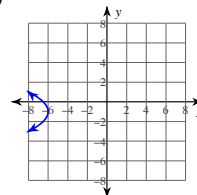
Vertex: $(-1, 1)$
Axis of Sym.: $y = 1$

121)



Vertex: $(6, -4)$
Axis of Sym.: $y = -4$

122)



Vertex: $(-6, -1)$
Axis of Sym.: $y = -1$

123) Center: $(-12, 13)$ Radius: $\sqrt{21}$ 124) Center: $(2, 14)$ Radius: $\sqrt{6}$ 125) Center: $(-15, -3)$

Radius: 2

126) Center: $(-2, 10)$

Radius: 5

127) Center: $(16, 2)$

Radius: 2

128) Center: $(-10, -12)$ Radius: $\sqrt{13}$ 129) Center: $(8, -16)$

Radius: 3

130) Center: $(6, 13)$

Radius: 1

131) Center: $(2\sqrt{39}, -\frac{13}{2})$

Radius: 2

132) Center: $(4, -7)$

Radius: 6

133) Center: $(11, 11)$

Radius: 5

134) Center: $(-10, -12)$

Radius: 6

135) Center: $(-8, 13)$ Radius: $3\sqrt{2}$ 136) Center: $(-16, 10)$

Radius: 2

137) Center: $(3, 11)$

Radius: 7

138) Center: $(-1, 2)$ Radius: $\sqrt{173}$ 139) Center: $(5, \frac{19}{2})$

Radius: 6

140) Center: $(1, -2)$ Radius: $\sqrt{43}$ 141) Center: $(2, -3)$

Radius: 13

142) Center: $(-13, -7)$

Radius: 4

143) Center: $(6, -12)$

Radius: 5

144) Center: $(-6, 11)$ Radius: $\sqrt{26}$ 145) Center: $(8, 0)$

Radius: 9

146) Center: $(-8, -16)$

Radius: 1

147) Center: $(4, -7)$

Radius: 8

148) Center: $(9, 16)$

Radius: 2

149) Center: $(10, 2)$

Radius: 5

150) Center: $(11, 12)$ Radius: $2\sqrt{5}$ 151) Center: $(-5, 11)$

Radius: 8

152) Center: $(16, 13)$

Radius: 3

153) $(x + 1)^2 + (y + 4)^2 = 4$ 154) $(x - 1)^2 + (y - 3)^2 = 4$ 155) $(x - 2)^2 + (y + 1)^2 = 16$ 156) $(x + 4)^2 + (y - 2)^2 = 4$ 157) $(x + 3)^2 + (y - 1)^2 = 4$ 158) $(x - 1)^2 + y^2 = 4$ 159) $(x + 4)^2 + (y - 1)^2 = 4$ 160) $(x - 3)^2 + (y + 2)^2 = 16$ 161) $(x - 4)^2 + (y + 3)^2 = 9$ 162) $x^2 + (y - 4)^2 = 1$ 163) $y = -\frac{1}{3}(x - 3)^2 + 6$ 164) $y = -2(x + 6)^2 - 2$ 165) $y = 2(x + 3)^2 - 4$ 166) $y = -x^2 + 2$ 167) $y = -(x - 6)^2 - 2$ 168) $y = -2(x - 4)^2 - 1$ 169) $y = -(x - 2)^2 - 5$ 170) $y = -3(x + 1)^2 - 4$ 171) $y = (x - 6)^2 + 1$ 172) $y = (x + 4)^2 - 3$ 173) $y = -(x - 2)^2 - 1$ 174) $y = -(x + 2)^2 - 1$ 175) $y = -2(x - 1)^2 - 4$ 176) $y = -(x + 1)^2 - 3$ 177) $y = 2(x - 2)^2 - 6$ 178) $y = (x - 3)^2 - 3$ 179) $y = -(x + 6)^2 - 1$ 180) $y = -(x + 3)^2 + 2$ 181) $y = (x - 1)^2$ 182) $y = -(x - 6)^2 - 6$ 183) Vertex: $(-6, -7)$
Axis of Sym.: $x = -6$

184) Vertex: (1, -7) 185) Vertex: (3, 5) 186) Vertex: (4, -4) 187) Vertex: (0, -6)
 Axis of Sym.: $x = 1$ Axis of Sym.: $x = 3$ Axis of Sym.: $x = 4$ Axis of Sym.: $x = 0$

188) Vertex: (-8, -5) 189) Vertex: (6, -5) 190) Vertex: (-7, 1)
 Axis of Sym.: $x = -8$ Axis of Sym.: $x = 6$ Axis of Sym.: $x = -7$

191) Vertex: (5, 1) 192) Vertex: (-3, 1) 193) Vertex: (7, 4)
 Axis of Sym.: $x = 5$ Axis of Sym.: $x = -3$ Axis of Sym.: $x = 7$

194) Vertex: (-10, -6) 195) Vertex: (-4, -9) 196) Vertex: (4, -8)
 Axis of Sym.: $x = -10$ Axis of Sym.: $x = -4$ Axis of Sym.: $x = 4$

197) Vertex: (10, -3) 198) Vertex: (9, 3) 199) Vertex: (4, -9)
 Axis of Sym.: $x = 10$ Axis of Sym.: $x = 9$ Axis of Sym.: $x = 4$

200) Vertex: (-2, 0) 201) Vertex: (2, -8) 202) Vertex: (9, 3)
 Axis of Sym.: $x = -2$ Axis of Sym.: $x = 2$ Axis of Sym.: $x = 9$

203) Vertex: (-9, 7) 204) Vertex: (-7, 10) 205) Vertex: (-9, 2)
 Axis of Sym.: $x = -9$ Axis of Sym.: $x = -7$ Axis of Sym.: $x = -9$

206) Vertex: (3, -9) 207) Vertex: (-8, -7) 208) Vertex: (6, 3)
 Axis of Sym.: $x = 3$ Axis of Sym.: $x = -8$ Axis of Sym.: $x = 6$

209) Vertex: (-8, 8) 210) Vertex: (-7, -10) 211) Vertex: (-3, -1)
 Axis of Sym.: $x = -8$ Axis of Sym.: $x = -7$ Axis of Sym.: $x = -3$

212) Vertex: (4, -9) 213) $(x + 15)^2 + (y + 9)^2 = 9$ 214) $(x - 16)^2 + (y - 3)^2 = 4$
 Axis of Sym.: $x = 4$

215) $(x + 4)^2 + (y + 2)^2 = 81$ 216) $(x + 1)^2 + (y + 14)^2 = 4$ 217) $(x + 5)^2 + (y - 9)^2 = 66$
 218) $(x - 6)^2 + (y - 16)^2 = 9$ 219) $(x - 11)^2 + (y + 7)^2 = 32$ 220) $(x - 5)^2 + (y + 5)^2 = 25$
 221) $(x + 13)^2 + (y - 12)^2 = 15$ 222) $(x - 9)^2 + (y - 4)^2 = 36$ 223) $(x - 12)^2 + (y - 14)^2 = 16$
 224) $(x - 10)^2 + (y + 7)^2 = 81$ 225) $(x + 10)^2 + (y + 12)^2 = 9$ 226) $x^2 + (y - 6)^2 = 16$
 227) $(x + 2)^2 + (y + 15)^2 = 10$ 228) $(x - 14)^2 + (y - 2)^2 = 16$ 229) $(x + 14)^2 + (y - 11)^2 = 1$
 230) $(x + 11)^2 + y^2 = 63$ 231) $(x - 2)^2 + (y + 5)^2 = 81$ 232) $(x - 8)^2 + (y - 5)^2 = 36$
 233) $(x - 6)^2 + (y - 10)^2 = 1$ 234) $(x - 4)^2 + (y - 10)^2 = 50$ 235) $x^2 + (y + 11)^2 = 40$
 236) $(x - 1)^2 + (y - 4)^2 = 218$ 237) $(x - 2)^2 + (y + 16)^2 = 5$ 238) $(x + 3)^2 + (y + 10)^2 = 65$
 239) $(x - 9)^2 + (y - 1)^2 = 100$ 240) $(x - 3)^2 + (y + 4)^2 = 113$ 241) $(x - 5)^2 + (y + 5)^2 = 185$
 242) $(x - 2)^2 + (y - 16)^2 = 1$ 243) $(x - 2)^2 + (y + 4)^2 = 4$ 244) $(x + 1)^2 + (y - 2)^2 = 9$
 245) $(x + 2)^2 + (y - 3)^2 = 9$ 246) $(x + 4)^2 + (y + 2)^2 = 1$ 247) $(x + 4)^2 + (y + 1)^2 = 4$
 248) $(x - 1)^2 + (y + 4)^2 = 4$ 249) $x^2 + (y - 2)^2 = 4$ 250) $(x + 3)^2 + (y - 4)^2 = 9$
 251) $(x - 4)^2 + y^2 = 9$ 252) $x^2 + (y + 3)^2 = 9$ 253) $y = -(x + 6)^2 + 1$ 254) $y = \frac{1}{2}(x - 4)^2 - 9$

255) $y = -7(x - 9)^2 - 7$ 256) $y = (x + 2)^2 + 10$ 257) $y = \frac{1}{2}(x - 3)^2 - 6$ 258) $y = -(x - 5)^2 + 8$

259) $y = -2(x + 5)^2 - 8$ 260) $y = -2(x - 4)^2 - 2$ 261) $y = 4(x - 1)^2$ 262) $y = (x - 2)^2 + 4$
 263) $y = -\frac{1}{3}(x + 9)^2 + 6$ 264) $y = -(x - 1)^2 + 7$ 265) $y = 11(x + 6)^2 - 7$

266) $y = 2(x - 9)^2 + 7$ 267) $y = (x + 3)^2 - 2$ 268) $y = -2(x + 9)^2 + 4$
 269) $y = -\frac{1}{2}(x + 6)^2 + 2$ 270) $y = -3(x + 4)^2 + 4$ 271) $y = -(x - 2)^2 - 10$

272) $y = -x^2 - 4$ 273) $y = 2(x + 1)^2 + 1$ 274) $y = 12(x - 5)^2 + 3$ 275) $y = (x - 9)^2 - 4$
 276) $y = -(x + 8)^2 + 5$ 277) $y = -(x + 4)^2 + 3$ 278) $y = 2(x - 10)^2 + 8$ 279) $y = 3(x + 8)^2 - 5$
 280) $y = 8(x + 3)^2 + 4$ 281) $y = -2(x - 6)^2 - 1$ 282) $y = 4(x + 8)^2 + 5$ 283) $y = 5(x - 6)^2 - 5$

284) $y = 2(x - 3)^2 + 2$ 285) $y = -\frac{1}{2}(x - 5)^2 + 5$ 286) $y = 2(x + 2)^2 - 6$

287) $y = (x + 9)^2 + 10$ 288) $y = 11(x + 5)^2 - 5$ 289) $y = (x - 9)^2 - 2$ 290) $y = 2(x - 5)^2 + 1$
 291) $y = -4(x + 5)^2 - 3$ 292) $y = -2(x - 1)^2 - 8$ 293) $y = -\frac{1}{2}(x + 10)^2 + 6$

294) $y = -3(x + 9)^2 - 4$ 295) $y = -17(x - 6)^2 - 4$ 296) $y = 2(x + 6)^2 + 6$
 297) $y = 3(x - 8)^2 + 8$ 298) $y = -\frac{1}{3}(x + 1)^2 - 4$ 299) $y = -(x + 1)^2 - 5$

300) $y = (x + 3)^2 + 4$ 301) $y = -(x + 8)^2 + 7$ 302) $y = \frac{1}{13}(x - 6)^2 - 3$

303) $y = (x + 5)^2 + 4$ 304) $y = 5(x - 6)^2 + 6$ 305) $y = (x - 9)^2 - 3$
 306) $y = 2(x - 10)^2 + 10$ 307) $y = -3(x - 7)^2 - 9$ 308) $y = (x + 1)^2 + 5$

309) $y = -\frac{1}{4}x^2 + 7$ 310) $y = -3(x - 2)^2 + 3$ 311) $x = -3(y + 3)^2 - 4$ 312) $y = (x + 2)^2 - 5$

313) $y = -2(x + 2)^2 - 2$ 314) $y = (x - 1)^2 + 3$ 315) $y = -\frac{1}{4}(x + 6)^2 - 1$

316) $y = -(x - 1)^2 + 4$ 317) $x = -(y - 5)^2 - 6$ 318) $y = (x - 1)^2 - 3$ 319) $y = 2(x + 6)^2 - 3$
 320) $y = 3(x + 3)^2 - 6$ 321) $y = -2(x - 4)^2 - 3$ 322) $y = x^2 + 3$ 323) $x = \frac{1}{2}(y + 6)^2 + 1$

324) $x = -2(y + 2)^2 - 1$ 325) $x = -(y - 6)^2 - 3$ 326) $x = -3(y + 5)^2 + 4$ 327) $x = -4(y - 4)^2 + 2$
 328) $y = (x + 2)^2 - 2$ 329) $y = -2(x + 2)^2 - 5$ 330) $y = (x - 5)^2 + 4$

331) $\frac{(x - 8)^2}{190} + \frac{(y - 1)^2}{130} = 1$ 332) $\frac{(x - 7)^2}{81} + \frac{(y + 9)^2}{49} = 1$ 333) $\frac{(x - \frac{17}{2})^2}{196} + \frac{(y + \frac{1}{2})^2}{16} = 1$

334) $\frac{(x + 2)^2}{16} + \frac{y^2}{25} = 1$ 335) $\frac{(x - 3)^2}{169} + \frac{(y + 8)^2}{49} = 1$ 336) $\frac{(x + 9)^2}{81} + \frac{(y + 2)^2}{36} = 1$

337) $\frac{(x - 8)^2}{100} + \frac{(y + 5)^2}{64} = 1$ 338) $\frac{(x - 3)^2}{100} + \frac{(y - 3)^2}{16} = 1$ 339) $\frac{(x + \frac{9}{2})^2}{81} + \frac{(y - 6)^2}{9} = 1$

340) $\frac{(x + 1)^2}{36} + \frac{(y - 10)^2}{9} = 1$ 341) $\frac{(x + 10)^2}{25} + \frac{(y - 6)^2}{36} = 1$ 342) $\frac{(x + 5)^2}{121} + \frac{(y + 2)^2}{9} = 1$
 343) $\frac{(x + 5)^2}{100} + (y - 9)^2 = 1$ 344) $\frac{(x + 2)^2}{15} + \frac{(y + 10)^2}{10} = 1$ 345) $(x + 2)^2 + \frac{(y - 4)^2}{9} = 1$

346) $\frac{(x + 2)^2}{25} + \frac{y^2}{49} = 1$ 347) $(x - 6)^2 + \frac{y^2}{9} = 1$ 348) $\frac{(x - 4)^2}{9} + \frac{y^2}{49} = 1$ 349) $\frac{x^2}{49} + \frac{y^2}{9} = 1$

350) $\frac{(x - 1)^2}{16} + \frac{y^2}{49} = 1$ 351) $\frac{x^2}{9} + \frac{(y - 2)^2}{25} = 1$ 352) $\frac{x^2}{36} + (y - 6)^2 = 1$

353) $\frac{(x + 4)^2}{9} + \frac{(y - 1)^2}{25} = 1$ 354) $\frac{(x - 5)^2}{4} + \frac{(y + 2)^2}{16} = 1$ 355) $\frac{(x - 2)^2}{9} + \frac{(y + 1)^2}{36} = 1$

356) $(x + 1)^2 + \frac{y^2}{49} = 1$ 357) $\frac{x^2}{49} + \frac{(y + 3)^2}{9} = 1$ 358) $\frac{(x + 1)^2}{25} + \frac{y^2}{36} = 1$

$$\begin{array}{lll}
359) \frac{(x-6)^2}{64} + \frac{(y-6)^2}{36} = 1 & 360) \frac{(x-1)^2}{121} + \frac{(y+6)^2}{9} = 1 & 361) \frac{(x-10)^2}{144} + \frac{y^2}{49} = 1 \\
362) \frac{(x+2)^2}{180} + \frac{y^2}{190} = 1 & 363) \frac{(x-6)^2}{81} + \frac{(y+3)^2}{16} = 1 & 364) \frac{(x-10)^2}{169} + \frac{(y-9)^2}{16} = 1 \\
365) \frac{(x-2)^2}{121} + \frac{(y-3)^2}{64} = 1 & 366) \frac{(x-7)^2}{81} + \frac{(y-8)^2}{64} = 1 & 367) \frac{(x+7)^2}{121} + \frac{(y+9)^2}{64} = 1 \\
368) \frac{(x+8)^2}{16} + \frac{(y-8)^2}{64} = 1 & 369) \frac{(x-9)^2}{195} + \frac{(y-3)^2}{75} = 1 & 370) \frac{(x-5)^2}{36} + \frac{(y-6)^2}{144} = 1 \\
371) \frac{(x-9)^2}{200} + \frac{(y+6)^2}{75} = 1 & 372) \frac{(x-5)^2}{49} + \frac{(y+9)^2}{64} = 1 & 373) \frac{(y-4)^2}{100} - \frac{(x+2)^2}{49} = 1 \\
374) \frac{(y-2)^2}{49} - \frac{(x+9)^2}{225} = 1 & 375) \frac{(y+9)^2}{25} - \frac{\left(x - \frac{15}{2}\right)^2}{64} = 1 & 376) \frac{(y+4)^2}{16} - \frac{(x-3)^2}{144} = 1 \\
377) \frac{(y-1)^2}{121} - \frac{(x+6)^2}{81} = 1 & 378) \frac{\left(y - \frac{19}{2}\right)^2}{64} - \frac{\left(x - \frac{17}{2}\right)^2}{36} = 1 & 379) \frac{(y-10)^2}{169} - \frac{(x-7)^2}{100} = 1 \\
380) \frac{(y-10)^2}{49} - \frac{(x+10)^2}{25} = 1 & 381) \frac{(y-7)^2}{16} - \frac{(x-2)^2}{121} = 1 & 382) \frac{(y+2)^2}{121} - \frac{(x-3)^2}{16} = 1 \\
383) \frac{(y+7)^2}{9} - \frac{(x+10)^2}{144} = 1 & 384) \frac{(y-8)^2}{64} - \frac{(x-3)^2}{16} = 1 & 385) \frac{(y+1)^2}{4} - \frac{(x-7)^2}{121} = 1 \\
386) \frac{(y+5)^2}{36} - \frac{(x+2)^2}{49} = 1 & 387) \frac{(y-3)^2}{16} - \frac{x^2}{36} = 1 & 388) \frac{\left(y - \frac{5}{2}\right)^2}{49} - \frac{\left(x - \frac{1}{2}\right)^2}{49} = 1 \\
389) \frac{(y-9)^2}{81} - \frac{x^2}{144} = 1 & 390) \frac{(y+9)^2}{49} - \frac{(x-4)^2}{16} = 1 & 391) \frac{(y-6)^2}{144} - \frac{(x+4)^2}{144} = 1 \\
392) \frac{(y+4)^2}{144} - \frac{(x-4)^2}{25} = 1 & 393) \frac{(y+10)^2}{81} - \frac{(x-8)^2}{100} = 1 & 394) \frac{(y-3)^2}{81} - \frac{(x-9)^2}{9} = 1 \\
395) \frac{(y-3)^2}{144} - \frac{(x+8)^2}{100} = 1 & 396) \frac{(y+1)^2}{169} - \frac{(x-8)^2}{121} = 1 & 397) \frac{y^2}{100} - \frac{(x-4)^2}{25} = 1 \\
398) \frac{(y+6)^2}{9} - \frac{(x+5)^2}{16} = 1 & 399) \frac{(y-5)^2}{36} - \frac{(x+5)^2}{9} = 1 & 400) \frac{(y-9)^2}{49} - (x+1)^2 = 1 \\
401) (y-4)^2 - \frac{(x+1)^2}{4} = 1 & 402) \frac{(y-2)^2}{9} - \frac{(x-1)^2}{16} = 1 & 403) \frac{y^2}{9} - \frac{(x+1)^2}{16} = 1 \\
404) \frac{y^2}{25} - \frac{x^2}{4} = 1 & 405) \frac{(y+1)^2}{9} - \frac{(x+1)^2}{9} = 1 & 406) \frac{(y+2)^2}{9} - \frac{x^2}{25} = 1 \\
407) \frac{(y-1)^2}{4} - \frac{x^2}{16} = 1 & 408) \frac{(y+1)^2}{4} - (x+3)^2 = 1 & 409) \frac{(y+1)^2}{4} - x^2 = 1 \\
410) \frac{y^2}{25} - \frac{(x+1)^2}{4} = 1 & 411) \frac{y^2}{25} - \frac{(x-1)^2}{9} = 1 & 412) (y+1)^2 - \frac{x^2}{25} = 1 \\
413) \frac{(y-1)^2}{16} - \frac{(x-1)^2}{16} = 1 & 414) \frac{(y+1)^2}{16} - \frac{(x+1)^2}{9} = 1 & 415) \frac{(y-2)^2}{4} - (x-3)^2 = 1
\end{array}$$

$$\begin{array}{lll}
416) (y+3)^2 - (x-2)^2 = 1 & 417) \frac{(y+3)^2}{4} - \frac{(x+2)^2}{9} = 1 & 418) (y+4)^2 - (x+3)^2 = 1 \\
419) (y-3)^2 - (x+1)^2 = 1 & 420) \frac{y^2}{25} - \frac{(x-1)^2}{16} = 1 & 421) \frac{(y+10)^2}{150} - \frac{(x-10)^2}{100} = 1 \\
422) \frac{(y-7)^2}{81} - \frac{(x-7)^2}{100} = 1 & 423) \frac{y^2}{196} - \frac{(x+6)^2}{144} = 1 & 424) \frac{(y+4)^2}{196} - \frac{(x+10)^2}{144} = 1 \\
425) (y+9)^2 - \frac{(x+1)^2}{4} = 1 & 426) \frac{(y+3)^2}{36} - \frac{(x-7)^2}{81} = 1 & 427) \frac{y^2}{121} - \frac{(x+2)^2}{64} = 1 \\
428) \frac{(y-7)^2}{115} - \frac{x^2}{130} = 1 & 429) \frac{(y+2)^2}{144} - \frac{(x+9)^2}{64} = 1 & 430) \frac{(y-10)^2}{100} - \frac{(x+9)^2}{49} = 1 \\
431) \frac{(y+6)^2}{4} - \frac{(x-3)^2}{36} = 1 & 432) \frac{(y-1)^2}{64} - \frac{(x+7)^2}{81} = 1 & 433) \frac{(y-3)^2}{169} - \frac{(x+1)^2}{81} = 1 \\
434) \frac{(y-4)^2}{25} - \frac{(x-4)^2}{25} = 1 & 435) \frac{(y-1)^2}{25} - \frac{(x+1)^2}{64} = 1 & 436) \frac{(y-9)^2}{9} - \frac{(x+6)^2}{9} = 1 \\
437) \frac{(y-6)^2}{4} - \frac{(x+10)^2}{25} = 1 & 438) \frac{(y-10)^2}{36} - \frac{\left(x + \frac{1}{2}\right)^2}{49} = 1 & 439) \frac{(y+4)^2}{130} - \frac{(x+10)^2}{15} = 1 \\
440) \frac{(y+8)^2}{49} - \frac{(x+5)^2}{49} = 1 & 441) Parabola
Latus Rectum: 25 units
Eccentricity: $\frac{\sqrt{29}}{2} \approx 2.693$ & 442) Parabola
Latus Rectum: 4 units
Eccentricity: 1 \\
443) Parabola
Latus Rectum: $\frac{1}{2}$ units
Eccentricity: 1 & 444) Circle
Eccentricity: 0 & 445) Circle
Eccentricity: 0 \\
446) Circle
Eccentricity: 0 & 447) Hyperbola
Latus Rectum: $\frac{8\sqrt{15}}{3}$ units
Eccentricity: $\frac{\sqrt{21}}{3} \approx 1.528$ & 448) Parabola
Latus Rectum: $\frac{1}{2}$ units
Eccentricity: 1 \\
449) Ellipse
Latus Rectum: $\frac{32}{5}$ units
Eccentricity: $\frac{3}{5} = 0.6$ & 450) Ellipse
Latus Rectum: $\frac{18}{7}$ units
Eccentricity: $\frac{2\sqrt{10}}{7} \approx 0.904$ & 451) Hyperbola
Latus Rectum: 1 unit
Eccentricity: $\frac{\sqrt{5}}{2} \approx 1.118$ \\
452) Hyperbola
Latus Rectum: $\frac{2}{5}$ units
Eccentricity: $\frac{\sqrt{26}}{5} \approx 1.02$ & 453) Hyperbola
Latus Rectum: 2 units
Eccentricity: $\frac{\sqrt{30}}{5} \approx 1.095$ & 454) Parabola
Latus Rectum: 3 units
Eccentricity: 1 \\
455) Circle
Eccentricity: 0
\end{array}$$

456) Ellipse
 Latus Rectum: $\frac{9}{2}$ units
 Eccentricity: $\frac{\sqrt{7}}{4} \approx 0.661$

459) Ellipse
 Latus Rectum: 1 unit
 Eccentricity: $\frac{\sqrt{3}}{2} \approx 0.866$

462) Hyperbola
 Latus Rectum: $\frac{9}{2}$ units
 Eccentricity: $\frac{5}{4} = 1.25$

465) Parabola
 Latus Rectum: 1 unit
 Eccentricity: 1

468) Parabola
 Latus Rectum: $\frac{7}{6}$ units
 Eccentricity: 1

457) Circle
 Eccentricity: 0

460) Parabola
 Latus Rectum: $\frac{1}{2}$ units
 Eccentricity: 1

463) Ellipse
 Latus Rectum: $\frac{8}{7}$ units
 Eccentricity: $\frac{3\sqrt{5}}{7} \approx 0.958$

466) Circle
 Eccentricity: 0

469) Circle
 Eccentricity: 0

458) Ellipse
 Latus Rectum: $\frac{8}{3}$ units
 Eccentricity: $\frac{\sqrt{5}}{3} \approx 0.745$

461) Ellipse
 Latus Rectum: $\frac{8}{3}$ units
 Eccentricity: $\frac{\sqrt{5}}{3} \approx 0.745$

464) Circle
 Eccentricity: 0

467) Circle
 Eccentricity: 0

470) Parabola
 Latus Rectum: 1 unit
 Eccentricity: 1