**Chapter 1**

**Parametric Equations and Polar Coordinates**

**1.2 Calculus of Parametric Curves**

**Section Exercises**

**For the following exercises, each set of parametric equations represents a line. Without eliminating the parameter, find the slope of each line.**

63. 

Answer: 0

65. 

Answer: 

**For the following exercises, determine the slope of the tangent line, then find the equation of the tangent line at the given value of the parameter.**

67. 

Answer:  

69. 

Answer: Slope is undefined; 

**For the following exercises, find all points on the curve that have the given slope.**

71. slope = 0.5

Answer:  

73. 

Answer: No points possible; undefined expression.

**For the following exercises, write the equation of the tangent line in Cartesian coordinates for the given parameter *t*.**

75. 

Answer: 

77. 

Answer: 

79. For  where  Find all values of *t* at which a vertical tangent line exists.

Answer: 

81. Find  for 

Answer: 

83. For the curve  find the slope and concavity of the curve at 

Answer:  and  so the curve is neither concave up nor concave down at 

**Therefore the graph is linear and has a constant slope but no concavity.**

85. Find the slope and concavity for the curve whose equation is  at

Answer:  the curve is concave down at 

87. Find all points on the curve  at which horizontal and vertical tangents exist.

Answer: No horizontal tangents. Vertical tangents at 

**For the following exercises, find **

89. 

Answer: 

**For the following exercises, find points on the curve at which tangent line is horizontal or vertical.**

91. 

Answer: Horizontal  vertical 

**For the following exercises, find  at the value of the parameter.**

93. 

Answer: 1

95. 

Answer: 0

**For the following exercises, find  at the given point without eliminating the parameter.**

97. 

Answer: 4

99. Determine the concavity of the curve 

Answer: Concave up on 

101. Find the area bounded by the curve and the lines  and 

Answer: 1

103. Find the area of the region bounded by  for 

Answer: 

**For the following exercises, find the area of the regions bounded by the parametric curves and the indicated values of the parameter.**

105. **[T]** 

Answer: 

107. **[T]**  (the “teardrop”)

Answer: 

**For the following exercises, find the arc length of the curve on the indicated interval of the parameter.**

109. 

Answer: 

111. 

Answer: 

113.  on the interval  (the hypocycloid)

Answer: 

115. Find the distance traveled by a particle with position  as *t* varies in the given time interval:

Answer: 

117. Show that the total length of the ellipse  is  where  and 

**For the following exercises, find the area of the surface obtained by rotating the given curve about the *x*-axis.**

119. 

Answer: 

121. **[T]** Use a CAS to find the area of the surface generated by rotating  about the *x*-axis. (Answer to three decimal places.)

Answer: 59.101

123. Find the area of the surface generated by revolving  about the *x*-axis.

Answer: 

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