**Chapter 3**

**Derivatives**

**3.6 The Chain Rule**

**Section Exercises**

**For the following exercises, given  and  find  by using Leibniz’s notation for the chain rule: .**

215. 

Answer:  = 

217. 

Answer:  =

219. 

Answer: = 

**For each of the following exercises,**

1. **decompose each function in the form  and  and**
2. **find  as a function of **

221. 

Answer: a.  b. 

223. 

Answer: a.  b. 

225. 

Answer: a. ; b. 

227. 

Answer: a. , b. 

**For the following exercises, find  for each function.**

229. 

Answer: 

231. 

Answer: 

233. 

Answer: 

235. 

Answer: 

237. 

Answer: 

239. Let  and suppose that  and  when Find 

Answer: 

241. [**T]** Find the equation of the tangent line to  at the origin. Use a calculator to graph the function and the tangent line together.

Answer: 

243. Find the -coordinates at which the tangent line to is horizontal.

Answer: 

**For the following exercises, use the information in the following table to find  at the given value for **

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| 0 | 2 | 5 | 0 | 2 |
| 1 | 1 | -2 | 3 | 0 |
| 2 | 4 | 4 | 1 | -1 |
| 3 | 3 | -3 | 2 | 3 |

245. 

Answer: 10

247. 

Answer: 

249. 

Answer: 

251. 

Answer: 

253. [**T]** The position function of a freight train is given by with  in meters and  in seconds. At time  s, find the train’s

1. velocity and
2. acceleration.
3. Using a. and b. is the train speeding up or slowing down?

Answer: a. m/s, b. m/s2, c. The train is slowing down since velocity and acceleration have opposite signs.

255. [**T]** The total cost to produce  boxes of Thin Mint Girl Scout cookies is  dollars, where In  weeks production is estimated to be  boxes.

1. Find the marginal cost 
2. Use Leibniz’s notation for the chain rule,  to find the rate with respect to time  that the cost is changing.
3. Use b. to determine how fast costs are increasing when  weeks. Include units with the answer.

Answer: a. b.  c. Approximately $90,300 per week

257. [**T]** The formula for the volume of a sphere is  where  (in feet) is the radius of the sphere. Suppose a spherical snowball is melting in the sun.

1. Suppose where  is time in minutes. Use the chain rule to find the rate at which the snowball is melting.
2. Use a. to find the rate at which the volume is changing at  min.

Answer: a.  b. The volume is decreasing at a rate of  ft3/min.

259. [**T]** The depth (in feet) of water at a dock changes with the rise and fall of tides. The depth is modeled by the function  where  is the number of hours after midnight. Find the rate at which the depth is changing at 6 a.m.

Answer:  ft/hr

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