**Chapter 4**

**Differentiation of Functions of Several Variables**

**4.5 The Chain Rule**

**Section Exercises**

**For the following exercises, use the information provided to solve the problem.**

215. Let  where  and  Find 

Answer: 

217. If  and  find  and 

Answer:  

219. If  and  find  and express the answer in terms of  and 

Answer: 

**For the following exercises, find  using the chain rule and direct substitution.**

221. , 

Answer: 

223. 

Answer: 

225.  

Answer: 

227. Let   and  Express as a function of  and find  directly. Then, find  using the chain rule.

Answer:  in both cases

229. Let  where  and  Find  when  and 

Answer: 

**For the following exercises, find  using partial derivatives.**

231. 

Answer: 

233. 

Answer: 

235. 

Answer: 

237. 

Answer: 

239. Find  using the chain rule where  and 

Answer: 

241. Let  and  Find 

Answer: 

243. Let  and  Find  and 

Answer:  and 

245. If   and  find  and  when  and 

Answer:  

247. If  and  find 

Answer: 

**For the following exercises, use this information: A function  is said to be homogeneous of degree  if  For all homogeneous functions of degree  the following equation is true:  Show that the given function is homogeneous and verify that **

249. 

Answer: 

251. The volume of a right circular cylinder is given by  where  is the radius of the cylinder and *y* is the cylinder height. Suppose  and  are functions of  given by  and  so that  are both increasing with time. How fast is the volume increasing when  and 

Answer:

253. The radius of a right circular cone is increasing at  cm/min whereas the height of the cone is decreasing at  cm/min. Find the rate of change of the volume of the cone when the radius is  cm and the height is  cm.

Answer:

255. A closed box is in the shape of a rectangular solid with dimensions  (Dimensions are in inches.) Suppose each dimension is changing at the rate of  in./min. Find the rate of change of the total surface area of the box when 

Answer: 

257. The temperature  at a point is and is measured using the Celsius scale. A fly crawls so that its position after  seconds is given by  and  where  are measured in centimeters. The temperature function satisfies  and . How fast is the temperature increasing on the fly’s path after  sec?

Answer: 

259. Let  where  Use a tree diagram and the chain rule to find an expression for 

Answer: 

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