**Chapter 6**

**Vector Calculus**

**6.2 Line Integrals**

**Section Exercises**

1. *True or False*. Line integral  is equal to a definite integral if *C* is a smooth curve defined on  and if function *f* is continuous on some region that contains curve *C*.

Answer: True

1. *True or False*. Vector functions   and   define the same oriented curve.

Answer: False

1. *True or False*. 

Answer: False

1. *True or False*. A piecewise smooth curve *C* consists of a finite number of smooth curves that are joined together end to end.

Answer: True

1. *True or False*. If *C* is given by  then 

Answer: False

**For the following exercises, use a computer algebra system (CAS) to evaluate the line integrals over the indicated path.**

1. **[T]** 

 from (0, 1, 0) to (1, 0, 0)

Answer: 

1. **[T]** 

 when 

Answer: 

1. **[T]**   when 

Answer: 

1. **[T]**Evaluate  where *C* is the right half of circle  and is traversed in the clockwise direction.

Answer: 

1. **[T]**Evaluate  where *C* is the line segment from  to (1, 2).

Answer: 

**For the following exercises, find the work done.**

1. Find the work done by vector field  on a particle moving along a line segment that goes from  to 

Answer: 

1. Find the work done by a person weighing 150 lb walking exactly one revolution up a circular, spiral staircase of radius 3 ft if the person rises 10 ft.

Answer: 

1. Find the work done by force field  on a particle as it moves along the helix  from point  to point 

Answer: 

1. Find the work done by vector field  in moving an object along path *C*, which joins points (1, 0) and (0, 1).

Answer: 

1. Find the work done by force  in moving an object along curve  where 

Answer: 

1. Find the mass of a wire in the shape of a circle of radius 2 centered at (3, 4) with linear mass density

Answer: 

**For the following exercises, evaluate the line integrals.**

1. Evaluate , where, and *C* is the part of the graph of from  to 

Answer: 

1. Evaluate , where  is the helix 

Answer: 

1. Evaluate  over the line segment from  to 

Answer: 

1. Let *C* be the line segment from point (0, 1, 1) to point (2, 2, 3). Evaluate line integral .

Answer: 

1. **[T]** Use a computer algebra system to evaluate the line integral  where *C* is the arc of the parabola  from (–5, –3) to (0, 2).

Answer: 

1. **[T]** Use a computer algebra system to evaluate the line integral  over the path *C* given by  where 

Answer: 

1. **[T]** Use a CAS to evaluate line integral  over path *C* given by  where 

Answer: 

1. Evaluate line integral where *C*lies along the *x*-axis from 

Answer: 

1. **[T]** Use a CAS to evaluate , where *C*is 

Answer: 

1. **[T]** Use a CAS to evaluate  where *C*is 

Answer: 

**In the following exercises, find the work done by force field F on an object moving along the indicated path.**

1. 



Answer: 

1. 

*C*: counterclockwise around the triangle with vertices (0, 0), (1, 0), and (1, 1)

Answer: 

1. 



Answer: 

1. Let **F** be vector field . Compute the work of integral  where *C* is the path 

Answer: 

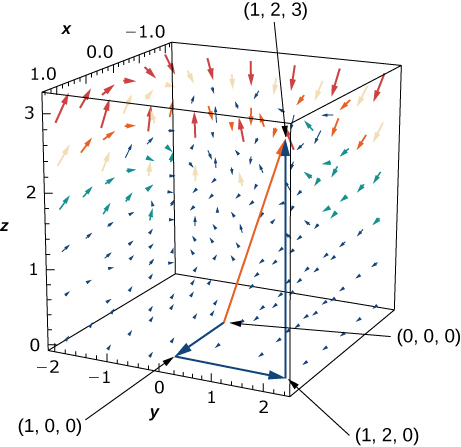
1. Compute the work done by force  along path , where .

Answer: 

1. Evaluate , where  and *C* is the segment of the unit circle going counterclockwise from  to (0, 1).

Answer: 

1. Force  acts on a particle that travels from the origin to point (1, 2, 3). Calculate the work done if the particle travels:
2. along the path  along straight-line segments joining each pair of endpoints;
3. along the straight line joining the initial and final points.
4. Is the work the same along the two paths?



Answer: a.  b.  c. Yes

1. Find the work done by vector field  on a particle moving along a line segment that goes from (1, 4, 2) to (0, 5, 1).

Answer: 

1. How much work is required to move an object in vector field  along the upper part of ellipse  from (2, 0) to 

Answer: 

1. A vector field is given by . Evaluate the line integral of the field around a circle of unit radius traversed in a clockwise fashion.

Answer: 

1. Evaluate the line integral of scalar function  along parabolic path  connecting the origin to point (1, 1).

Answer: 

1. Find  along *C*:  from (0, 0) to (1, 3).

Answer: 

1. Find  along *C*:  from (0, 0) to (1, 3).

Answer: 

**For the following exercises, use a CAS to evaluate the given line integrals.**

1. **[T]** Evaluate  where *C* is represented by 

Answer: 

1. **[T]** Evaluate line integral  where,  is the arc of curve  from  to 

Answer: 

1. **[T]** Evaluate the integral  where  is a triangle with vertices (0, 1, 2), (1, 0, 3), and 

Answer: 

1. **[T]** Evaluate line integral  where  is curve  from

(1, 0) toward 

Answer: 

1. **[T]** Evaluate line integral where  is the right half of circle 

Answer: 

1. **[T]** Evaluate , where  and

*C*: 

Answer: 

1. Evaluate , where  and

*C* is any path from  to (5, 1).

Answer: 

1. Find the line integral of  over path *C* defined by ,  from point (0, 0, 0) to point (2, 4, 8).

Answer: 

1. Find the line integral of  where *C* is ellipse  from 

Answer: 

**For the following exercises, find the flux.**

1. Compute the flux of  across a line segment from (0, 0) to (1, 2).

Answer: 

1. Let  and let *C* be curve  Find the flux across *C*.

Answer: 

1. Let  and let *C* be curve  Find the flux across *C*.

Answer: 

1. Let  and let *C*:  . Calculate the flux across *C*.

Answer: 

1. Let  Calculate flux **F** orientated counterclockwise across curve *C*: 

Answer: 

1. Find the line integral of  where *C* consists of two parts:  and   is the intersection of cylinder  and plane  from (0, 4, 3) to   is a line segment from  to (0, 1, 5).

Answer: 

1. A spring is made of a thin wire twisted into the shape of a circular helix  Find the mass of two turns of the spring if the wire has constant mass density.

Answer: 

1. A thin wire is bent into the shape of a semicircle of radius *a*. If the linear mass density at point *P* is directly proportional to its distance from the line through the endpoints, find the mass of the wire.

Answer: 

1. An object moves in force field  counterclockwise from point (2, 0) along elliptical path  to  and back to point (2, 0) along the *x*-axis. How much work is done by the force field on the object?

Answer: 

1. Find the work done when an object moves in force field  along the path given by , 

Answer: 

1. If an inverse force field **F** is given by  where *k* is a constant, find the work done by **F** as its point of application moves along the *x*-axis from 

Answer: 

1. David and Sandra plan to evaluate line integral  along a path in the *xy*-plane from (0, 0) to (1, 1). The force field is  David chooses the path that runs along the *x*-axis from (0, 0) to (1, 0) and then runs along the vertical line  from (1, 0) to the final point (1, 1). Sandra chooses the direct path along the diagonal line  from (0, 0) to (1, 1). Whose line integral is larger and by how much?

Answer: Sandra’s by 

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