



MATLAB-EXPERIMENT 5B

Line integral and work done



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MAT 1011 – Calculus for Engineers (MATLAB)

Experiment 5-B

Line integral and work done

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1. 1) Find the work done for the force
 $\vec{F}(x,y,z) = yz\vec{i} + xz\vec{j} + (xy+2z)\vec{k}$
along the line segment from (1,0,-2)
to (4,6,3).

CODE:

```
% Find the work done for the force f(x,y,z)= yz
i + xz j + (xy+2z)k along the line segment from
(1,0,-2) to (4,6,3).
clear;
close all;
clc;
syms x y z t;

func = [y*z, x*z, (x*y+2*z)];
disp("The given function = ");
disp(func);
```

```

pointa = [1, 0, -2];
pointb = [4, 6, 3];
disp("The given points of line segment = ");
disp(pointa);
disp(pointb);
par = pointa .* (1 - t) + pointb .* t;
disp("Parametric equations are = "); disp(par);
interval = [0,1];
a = interval(1);
b = interval(2);
dpar = diff(par, t);
F = subs(func, {x, y, z}, par);
Fdpar = sum(F .* dpar);
integral = int(Fdpar, t, a, b);
disp("Work done by the force F = ");
disp(integral);
fx(x, y, z) = func(1);
fy(x, y, z) = func(2);
fz(x, y, z) = func(3);
[xcords, ycords, zcords] = meshgrid(linspace(-
4, 4, 10));
U = fx(xcords, ycords, zcords);
V = fy(xcords, ycords, zcords);
W = fz(xcords, ycords, zcords);

figure(1);
quiver3(xcords, ycords, zcords, U, V, W);
hold on;
grid on;
tvals = linspace(0, 1, 10);

```

```

x1 = subs(par(1), tvals); y1 = subs(par(2),
tvals); z1 = subs(par(3), tvals);
plot3(x1, y1, z1, 'r');
xlabel("X-axis");
ylabel("Y-axis");
zlabel("Z-axis");
hold off;

```

OUTPUT:

The given function =
 $[y*z, x*z, 2*z + x*y]$

The given points of line segment =

1	0	-2
4	6	3

Parametric equations are =
 $[3*t + 1, 6*t, 5*t - 2]$

Work done by the force F =
 77

```

1  % Find the work done for the force  $f(x,y,z)= yz \mathbf{i} + xz \mathbf{j} + (xy+2z)\mathbf{k}$  along the line segment from
2  clear;
3  close all;
4  clc;
5  syms x y z t;
6
7  func = [y*z, x*z, (x*y+2*z)];
8  disp("The given function = ");
9  disp(func);
10 pointa = [1, 0, -2];
11 pointb = [4, 6, 3];
12 disp("The given points of line segment = ");
13 disp(pointa);
14 disp(pointb);
15 par = pointa .* (1 - t) + pointb .* t;
16 disp("Parametric equations are = "); disp(par);
17 interval = [0,1];
18 a = interval(1);
19 b = interval(2);
20 dpar = diff(par, t);
21 F = subs(func, {x, y, z}, par);
22 Fdpar = sum(F .* dpar);
23 integral = int(Fdpar, t, a, b);
24 disp("Work done by the force F = ");
25 disp(integral);
26 fx(x, y, z) = func(1);
27 fy(x, y, z) = func(2);
28 fz(x, y, z) = func(3);
29 [xcords, ycords, zcords] = meshgrid(linspace(-4, 4, 10));
30 U = fx(xcords, ycords, zcords);
31 V = fy(xcords, ycords, zcords);
32 W = fz(xcords, ycords, zcords);
33
34 figure(1);|
35 quiver3(xcords, ycords, zcords, U, V, W);
36 hold on;
37 grid on;
38 tvals = linspace(0, 1, 10);
39 x1 = subs(par(1), tvals); y1 = subs(par(2), tvals); z1 = subs(par(3), tvals);
40 plot3(x1, y1, z1, 'r');
41 xlabel("X-axis");
42 ylabel("Y-axis");
43 zlabel("Z-axis");
44 hold off;

```

Command Window

The given function =

$[y*z, x*z, 2*z + x*y]$

The given points of line segment =

1 0 -2

4 6 3

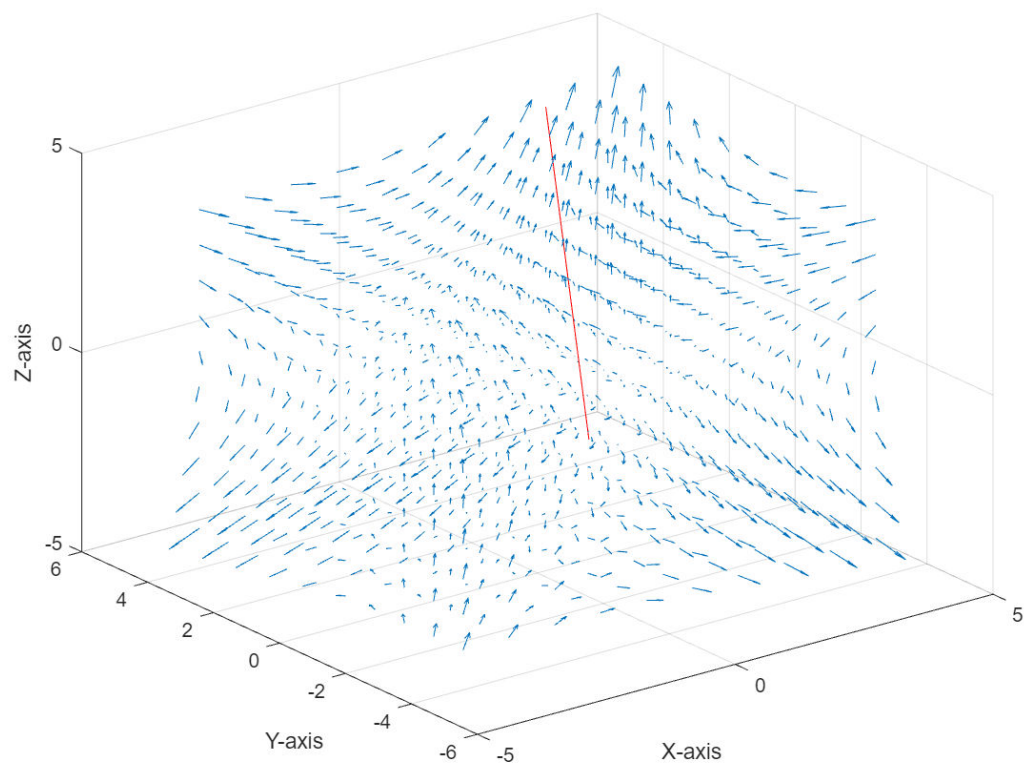
Parametric equations are =

$[3*t + 1, 6*t, 5*t - 2]$

Work done by the force F =

77

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2. Find the work done for the force $\vec{F}(x,y,z) = x^2 \vec{i} + y^2 \vec{j} + z^2 \vec{k}$ along the arc of the parabola $y = 2x^2$ from $(-1,2)$ to $(2,8)$.

CODES:

```
% Find the work done for the force f(x,y,z)= yz  
i + xz j + (xy+2z) k along the line segment  
from (0,0,2) to (4,6,3).
```

```
clear;  
close all;  
clc;  
syms x y z t;  
  
func = [y*z, x*z, (x*y+2*z)];  
disp("The given function = ");  
disp(func);  
pointa = [0, 0, 0];  
pointb = [4, 6, 3];  
disp("The given points of line segment = ");  
disp(pointa);  
disp(pointb);  
par = pointa .* (1 - t) + pointb .* t;  
disp("Parametric equations are = "); disp(par);  
interval = [0,1];  
a = interval(1);
```



```

b = interval(2);
dpar = diff(par, t);
F = subs(func, {x, y, z}, par);
Fdpar = sum(F .* dpar);
integral = int(Fdpar, t, a, b);
disp("Work done by the force F = ");
disp(integral);
fx(x, y, z) = func(1);
fy(x, y, z) = func(2);
fz(x, y, z) = func(3);
[xcords, ycords, zcords] = meshgrid(linspace(-
4, 4, 10));
U = fx(xcords, ycords, zcords);
V = fy(xcords, ycords, zcords);
W = fz(xcords, ycords, zcords);

figure(1);
quiver3(xcords, ycords, zcords, U, V, W);
hold on;
grid on;
tvals = linspace(0, 1, 10); x1 = subs(par(1),
tvals); y1 = subs(par(2), tvals); z1 =
subs(par(3), tvals);
plot3(x1, y1, z1, 'r');
xlabel("X-axis");
ylabel("Y-axis");
zlabel("Z-axis");
hold off;

```

OUTPUT:

The given function =
 $[y*z, x*z, 2*z + x*y]$

The given points of line segment =
 $\begin{matrix} 0 & 0 & 0 \end{matrix}$

$\begin{matrix} 4 & 6 & 3 \end{matrix}$

Parametric equations are =
 $[4*t, 6*t, 3*t]$

Work done by the force F =
81

```

1 % Find the work done for the force  $f(x,y,z)=yz\mathbf{i} + xz\mathbf{j} + (xy+2z)\mathbf{k}$  along the line segment from  $(0,0,2)$  to  $(4,6,3)$ 
2
3 clear;
4 close all;
5 clc;
6 syms x y z t;
7
8 func = [y*z, x*z, (x*y+2*z)];
9 disp("The given function = ");
10 disp(func);
11 pointa = [0, 0, 0];
12 pointb = [4, 6, 3];
13 disp("The given points of line segment = ");
14 disp(pointa);
15 disp(pointb);
16 par = pointa .* (1 - t) + pointb .* t;
17 disp("Parametric equations are = "); disp(par);
18 interval = [0,1];
19 a = interval(1);
20 b = interval(2);
21 dpar = diff(par, t);
22 F = subs(func, {x, y, z}, par);
23 Fdpar = sum(F .* dpar);
24 integral = int(Fdpar, t, a, b);
25 disp("Work done by the force F = ");
26 disp(integral);
27 fx(x, y, z) = func(1);
28 fy(x, y, z) = func(2);
29 fz(x, y, z) = func(3);
30 [xcords, ycords, zcords] = meshgrid(linspace(-4, 4, 10));
31 U = fx(xcords, ycords, zcords);
32 V = fy(xcords, ycords, zcords);
33 W = fz(xcords, ycords, zcords);
34
35 figure(1);
36 quiver3(xcords, ycords, zcords, U, V, W);
37 hold on;
38 grid on;
39 tvals = linspace(0, 1, 10); x1 = subs(par(1), tvals); y1 = subs(par(2), tvals); z1 = subs(par(3), tvals);
40 plot3(x1, y1, z1, 'r');
41 xlabel("X-axis");
42 ylabel("Y-axis");
43 zlabel("Z-axis");
44 hold off;

```

Command Window

The given function =

$[y*z, x*z, 2*z + x*y]$

The given points of line segment =

0 0 0

4 6 3

Parametric equations are =

$[4*t, 6*t, 3*t]$

Work done by the force F =

81

|

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Figure 1 x +

