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```
%Mathias Frazier
%Section 242
%Matlab Project 1
```

Task 1

```
syms y(t)

dsolve(diff(y,1) == t^2 + sin(t))
```

```
ans =

C1 - cos(t) + t^3/3
```

Task 2

```
dsolve(diff(y,1)-(2*t*y)==t)
```

```
ans =

(C1*exp(t^2))/2 - 1/2
```

Task 3

```
dsolve((1+(1/y^2))*diff(y,1)==t)
```

```
ans =
```

```
C1/2 - (4*C1^2 + 4*C1*t^2 + t^4 + 16)^(1/2)/4 + t^2/4
C1/2 + (4*C1^2 + 4*C1*t^2 + t^4 + 16)^(1/2)/4 + t^2/4
```

Task 4

```
dsolve(((diff(y,1))^2) + 1==0)
```

```
ans =

C1 - t*1i
C2 + t*1i
```

Task 5

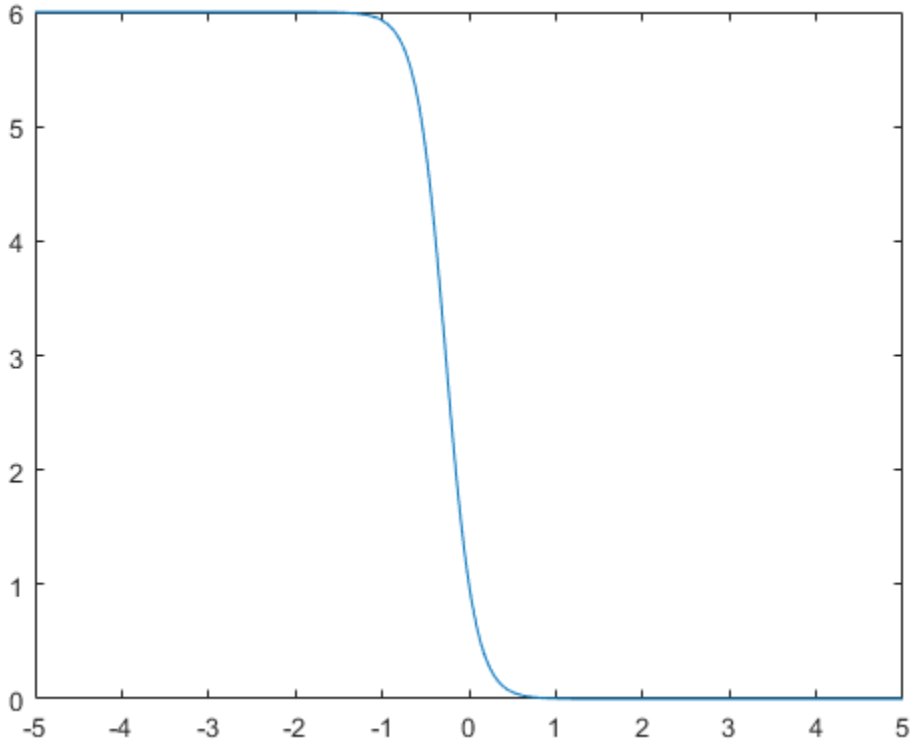
```
dsolve(diff(y,1) + (2*t*y) == t, y(2) == -3)
```

```
ans =

1/2 - (7*exp(4)*exp(-t^2))/2
```

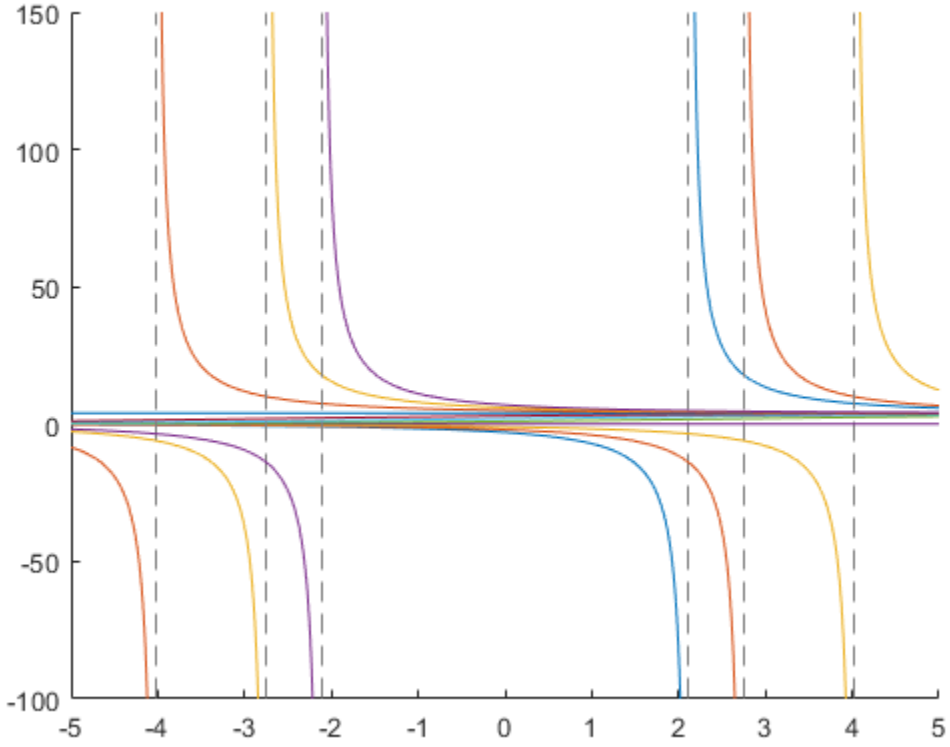
Task 6

```
fplot(dsolve(diff(y,1) == y * (y-6), y(0) == 1))
```



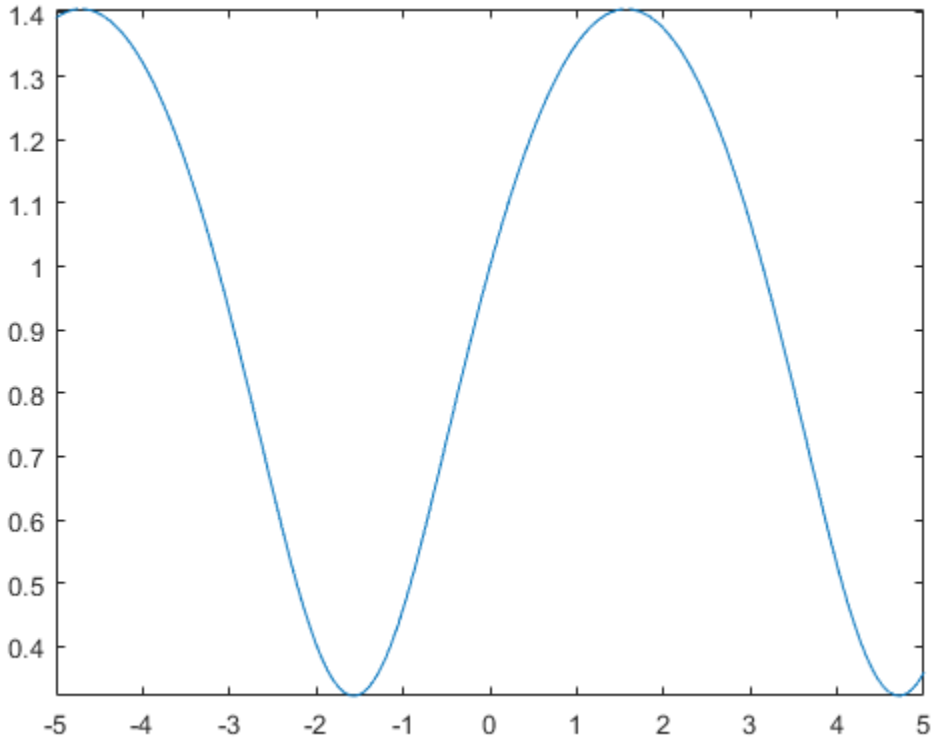
Task 7

```
figure;
hold on
for v = [-3:7]
fplot(dsolve(diff(y,1) == 0.1*y*(4-y), y(0) == v))
end
hold off
```



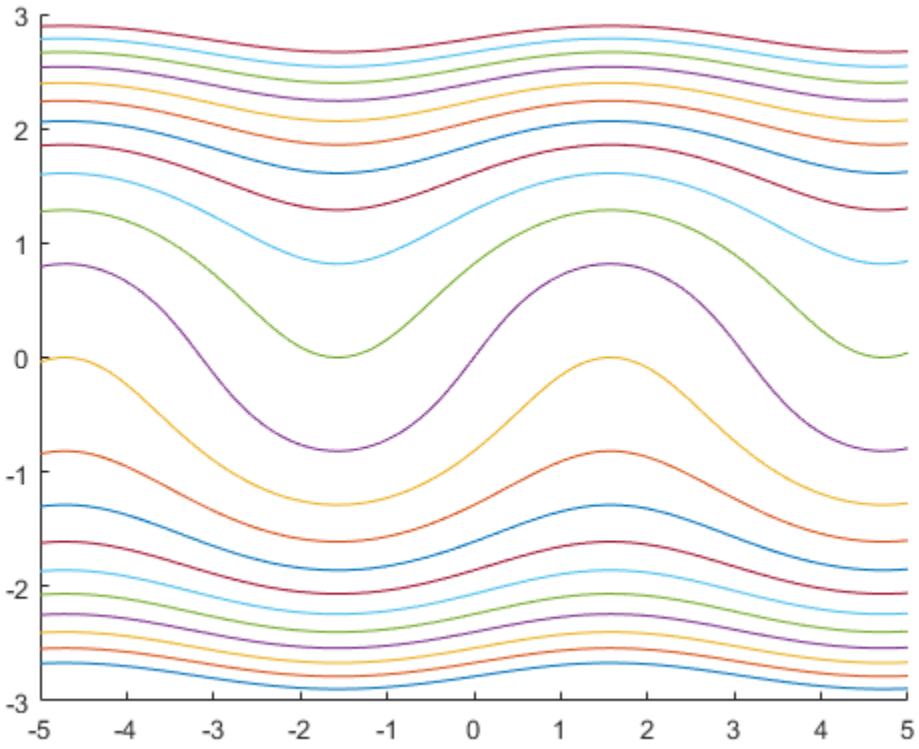
Task 8

```
syms y t;
figure;
fimplicit((y^3+3*y == 3*sin(t)+4))
```



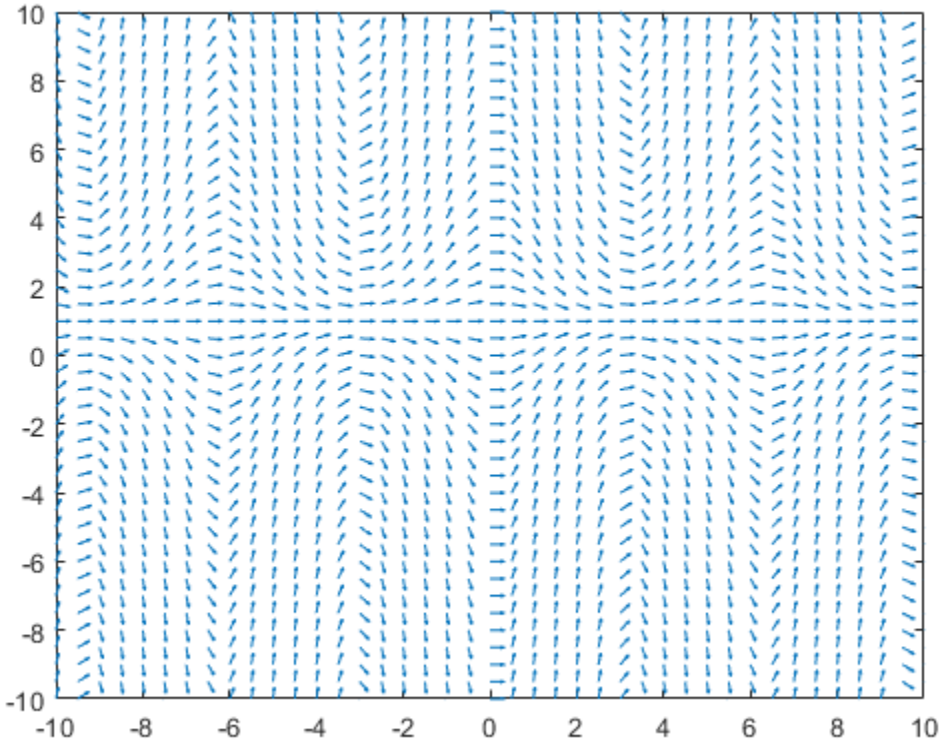
Task 9

```
syms y t;
figure;
hold on
for C = [-10:10]
fimplicit(y^3 + 3*y == 3*sin(t) + 3*C)
end
hold off
```



Task 10

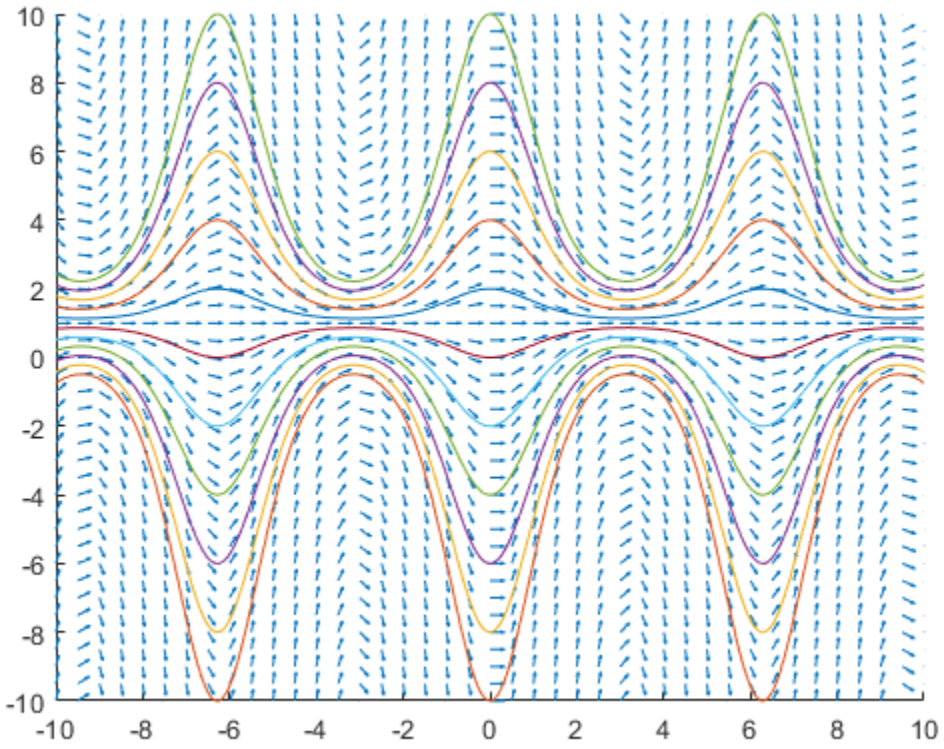
```
clear all
figure;
syms t y;
[T, Y] = meshgrid(-10:0.5:10, -10:0.5:10);
S = (1-Y).*(sin(T));
L = sqrt(1 + S.^2);
quiver(T, Y, 1./L, S./L, 0.5)
ylim([-10 10])
xlim([-10 10])
```



Task 11

```
figure;
hold on
syms t y;
[T, Y] = meshgrid(-10:0.5:10, -10:0.5:10);
S = (1-Y).*(sin(T));
L = sqrt(1 + S.^2);
quiver(T, Y, 1./L, S./L, 0.5)
ylim([-10 10])
xlim([-10 10])

for v = [-10:2:10]
syms y(t)
fplot(dsolve(diff(y,1) == (1-y)*sin(t), y(0)==v))
end
hold off
```



Task 12

```
syms f(t,y);
f(t,y) = (t^2+y)/y;
t = 3; y = -1; h = 0.1; n = 20;
for s = [1:n]
y = vpa(y + h*f(t,y));
t = t+h;
end
y
```

```
y =

-7.048005874065966772695089197065 5
```

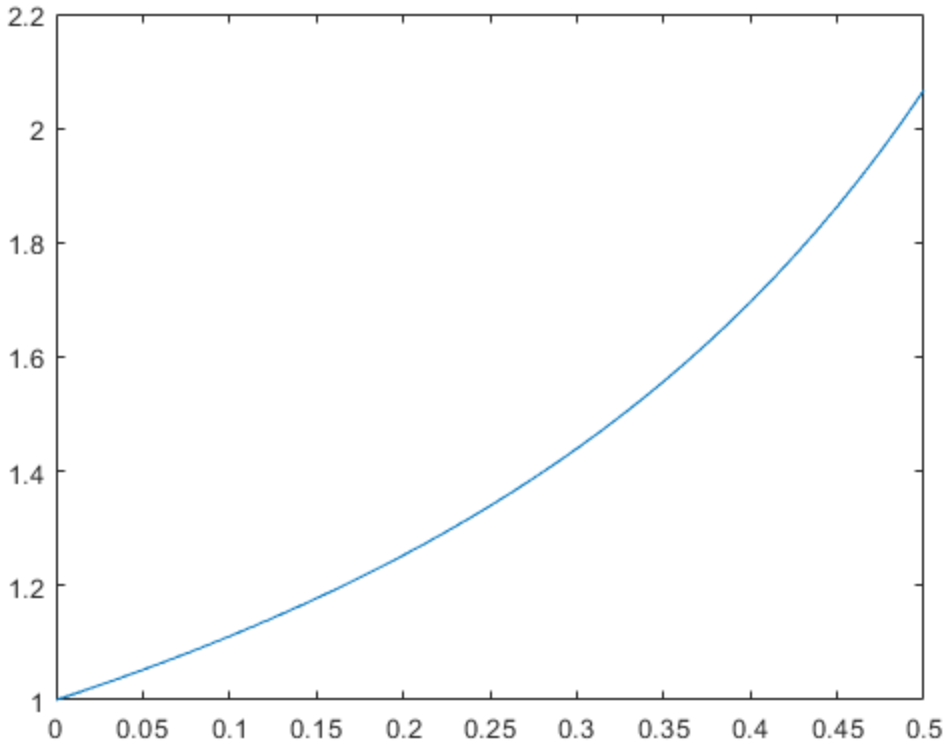
Task 13

```
syms t y;
yprime = t^2 + y^2;
y0 = 1;
tspan = [0 0.5];
[t,y] = ode45(@(t,y) t^2 + y^2,tspan, y0);
```

```
plot(t,y)
```

```
disp("According to our plot, y(0.5), is roughly 2.067")
```

```
According to our plot, y(0.5), is roughly 2.067
```



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