Question 1:

```
syms x g f

eqn = 2*x - 3 == 3;
f = solve(eqn, x)
```

f = 3

```
g   = 7*f + 5
```

g = 26

Question 2:

```
syms a x b

eqn = a*x - b == 0;
f = solve(eqn, x)
```

f =

$$\frac{b}{a}$$

```
g = a*f + b
```

g = $2\,b$

Question 3:

```
syms c y d

eqn = c*y - d == 0;
f = solve(eqn, d)
```

f = $c\,y$

Question 4:

```
syms x y z

eqn1 = 3*x + 2*y + z == 2;
eqn2 = x + 2*y + z == 0;
eqn3 = 2*x - y - z == 1;

S = solve(eqn1, eqn2, eqn3, {x, y, z});
```

```
X = S.x
```

X = 1

```
Y = S.y
```

Y = -2

```
Z = S.z
```

Z = 3

```
A = X + Y + Z
```

A = 2

Question 5:

```
syms x y

eqn1 = x^2 + y^2 == 9;
eqn2 = 2*x + 3*y == 4;

f = solve(eqn1, y);
f(1)
```

ans = $\sqrt{3-x}\ \sqrt{x+3}$

```
f(2)
```

ans = $-\sqrt{3-x}\ \sqrt{x+3}$

```
fplot(f, 'g', [-5,5])
hold on;
ylim([-5,5])

g = solve(eqn2, y)
```

g =

$$\frac{4}{3}-\frac{2\,x}{3}$$

```
fplot(g, 'm')

Z = solve(eqn1, eqn2);
Z.x
```

ans =

$$\begin{pmatrix} \dfrac{3\sqrt{101}}{13} + \dfrac{8}{13} \\[4mm] \dfrac{8}{13} - \dfrac{3\sqrt{101}}{13} \end{pmatrix}$$
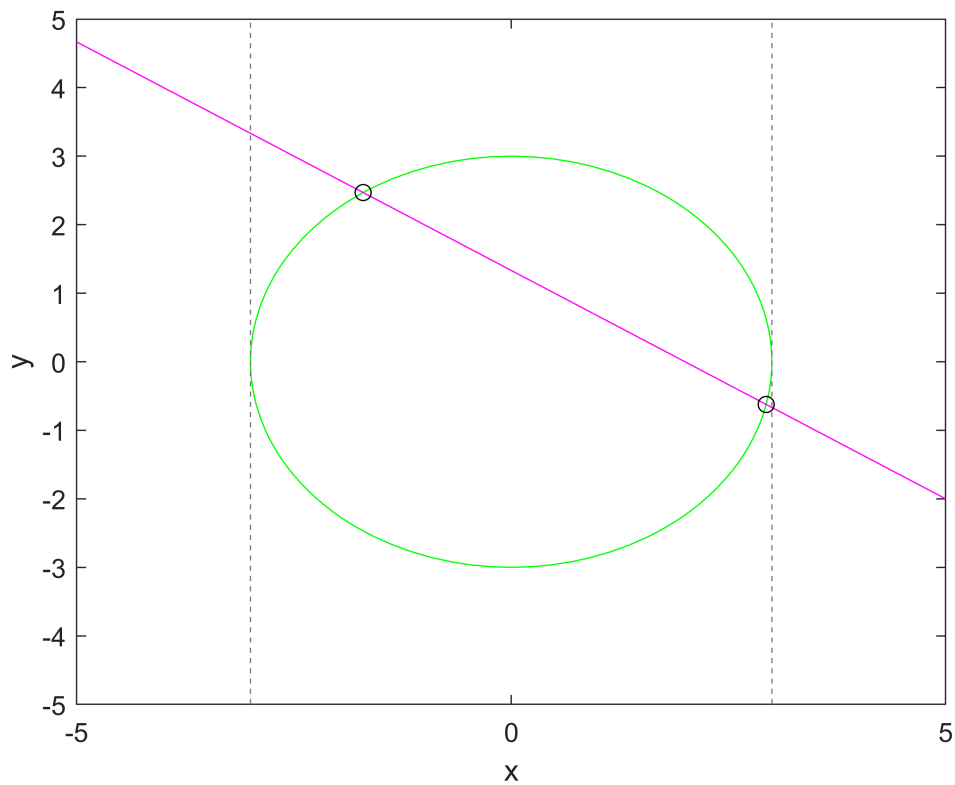
```
Z.y
```

ans =

$$\begin{pmatrix} \dfrac{12}{13} - \dfrac{2\sqrt{101}}{13} \\[4mm] \dfrac{2\sqrt{101}}{13} + \dfrac{12}{13} \end{pmatrix}$$

```matlab
plot(Z.x, Z.y, 'ko')

xlabel('x')
ylabel('y')
hold off;
```



```
diff(g)
```

ans =

$$-\dfrac{2}{3}$$

```
A = diff(f(1))
```

A =

$$\frac{\sqrt{3-x}}{2\sqrt{x+3}} - \frac{\sqrt{x+3}}{2\sqrt{3-x}}$$

```
B = diff(f(2))
```

B =

$$\frac{\sqrt{x+3}}{2\sqrt{3-x}} - \frac{\sqrt{3-x}}{2\sqrt{x+3}}$$

```
subs(A,x,Z.x)
```

ans =

$$\begin{pmatrix} \dfrac{\sqrt{\frac{31}{13}-\sigma_1}}{2\sqrt{\sigma_1+\frac{47}{13}}} - \dfrac{\sqrt{\sigma_1+\frac{47}{13}}}{2\sqrt{\frac{31}{13}-\sigma_1}} \\[2em] \dfrac{\sqrt{\sigma_1+\frac{31}{13}}}{2\sqrt{\frac{47}{13}-\sigma_1}} - \dfrac{\sqrt{\frac{47}{13}-\sigma_1}}{2\sqrt{\sigma_1+\frac{31}{13}}} \end{pmatrix}$$

where

$$\sigma_1 = \frac{3\sqrt{101}}{13}$$

```
subs(B, x,Z.x)
```

ans =

$$\begin{pmatrix} \dfrac{\sqrt{\sigma_1+\frac{47}{13}}}{2\sqrt{\frac{31}{13}-\sigma_1}} - \dfrac{\sqrt{\frac{31}{13}-\sigma_1}}{2\sqrt{\sigma_1+\frac{47}{13}}} \\[2em] \dfrac{\sqrt{\frac{47}{13}-\sigma_1}}{2\sqrt{\sigma_1+\frac{31}{13}}} - \dfrac{\sqrt{\sigma_1+\frac{31}{13}}}{2\sqrt{\frac{47}{13}-\sigma_1}} \end{pmatrix}$$

where

$$\sigma_1 = \frac{3\sqrt{101}}{13}$$

Question 6:

```
syms x y c

eqn1 = x^2 + y^2 == 9;
eqn2 = 2*x + 3*y == c;

f = solve(eqn1, y);
f(1)
```

ans = $\sqrt{3-x}\ \sqrt{x+3}$

```
f(2)
```

ans = $-\sqrt{3-x}\ \sqrt{x+3}$

```
fplot(f, 'g',[-5, 5])
hold on;
ylim([-5,5])

g = solve(eqn2, y)
```

g =

$$\frac{c}{3} - \frac{2\,x}{3}$$

```
Z = solve(eqn1, eqn2);
X = Z.x
```

X =

$$\left(\begin{array}{c} \dfrac{2\,c}{13} + \dfrac{3\,\sqrt{\dfrac{144}{13} - \dfrac{16\,c^2}{169}}}{4} \\[2em] \dfrac{2\,c}{13} - \dfrac{3\,\sqrt{\dfrac{144}{13} - \dfrac{16\,c^2}{169}}}{4} \end{array} \right)$$

```
Y = Z.y
```

Y =

$$\left(\begin{array}{c} \dfrac{3\,c}{13} - \dfrac{\sqrt{\dfrac{144}{13} - \dfrac{16\,c^2}{169}}}{2} \\[2em] \dfrac{3\,c}{13} + \dfrac{\sqrt{\dfrac{144}{13} - \dfrac{16\,c^2}{169}}}{2} \end{array} \right)$$

```
X;
X(1)
```

ans =

$$2\frac{c}{13} + \frac{3\sqrt{\frac{144}{13} - \frac{16c^2}{169}}}{4}$$

```
X(2)
```

ans =

$$2\frac{c}{13} - \frac{3\sqrt{\frac{144}{13} - \frac{16c^2}{169}}}{4}$$

```
C = solve(X(1) == X(2), c);
C(1)
```

ans = $-3\sqrt{13}$

```
C(2)
```

ans = $3\sqrt{13}$

```
G(1) = subs(g, c, C(1));
G(2) = subs(g, c, C(2));
fplot(G(1), 'm')
fplot(G(2), 'm')

X = subs(X, c, C)
```

X =

$$\begin{pmatrix} -\frac{6\sqrt{13}}{13} \\ \frac{6\sqrt{13}}{13} \\ -\frac{6\sqrt{13}}{13} \\ \frac{6\sqrt{13}}{13} \end{pmatrix}$$

```
Y = subs(Y, c , C)
```

Y =

$$\begin{pmatrix} -\dfrac{9\sqrt{13}}{13} \\[1.5em] \dfrac{9\sqrt{13}}{13} \\[1.5em] -\dfrac{9\sqrt{13}}{13} \\[1.5em] \dfrac{9\sqrt{13}}{13} \end{pmatrix}$$

```
plot(X,Y, 'ko')

subs(g, x, X);
subs(g,c, C);
slope1 = diff(g)
```

slope1 =

$$-\frac{2}{3}$$

```
q = diff(f);
slope2 = simplify(subs(q, x, X))
```

slope2 =

$$\begin{pmatrix} \dfrac{2}{3} \\[1em] -\dfrac{2}{3} \\[1em] \dfrac{2}{3} \\[1em] -\dfrac{2}{3} \\[1em] -\dfrac{2}{3} \\[1em] \dfrac{2}{3} \\[1em] -\dfrac{2}{3} \\[1em] \dfrac{2}{3} \end{pmatrix}$$

```
hold off;
```