$$
f(x)=(x+3)(x+2)(x-1)
$$

crosses $x$ when $y=0$

$$
\begin{aligned}
& (x+3)(x+2)(x-1)=0 \\
& x=-3 \quad x=-2 \quad x=1
\end{aligned}
$$

crosses $y$ when $x=0$

$$
y=(3)(2)(-1)=-6
$$

$$
y=f(x)
$$


bis

ii) $y=f(-x)$

$2 a)$

$$
\begin{aligned}
& y=x^{2}+5 x \\
& y=x(x+5)
\end{aligned}
$$

crosses $x$ when $y=0 \quad x(x+5)=0$

$$
x=0 \quad x=-5
$$


b)

$$
\begin{aligned}
x^{2}+5 x+\frac{1}{x} & =0 \\
x^{2}+5 x & =-\frac{1}{x}
\end{aligned}
$$

There is one solution as the graph intersects once.

3 i)

ü)


$$
\begin{aligned}
f(x) & =x^{2}+4 x+5 \\
& =(x+2)^{2}-4+5 \\
& =(x+2)^{2}+1
\end{aligned}
$$

minimum point at $(-2,1)$
b) crosses $y$ when $x=0 \quad y=(0)^{2}+4(0)+5$

$$
=5
$$


c) i/ $(2,2)$
ii) $(-2,0.5)$
$5 a$

$$
\begin{aligned}
f(x) & =x\left(x^{2}+4 x-5\right) \\
& =x(x-1)(x+5)
\end{aligned}
$$

crosses $x$ when $y=0$

$$
\begin{aligned}
& x(x-1)(x+5)=0 \\
& x=0 \quad x=1 \quad x=-5
\end{aligned}
$$

$$
y=f(x)
$$


bi) $y=f(x+1)$

ii) $y=f(2 x)$


$$
y=\frac{1}{x}+2
$$

crosses $y$ when $x=0 \quad X$ (No solutions)
crosses $x$ when $y=0$

$$
\begin{aligned}
& 0=\frac{1}{x}+2 \\
&-2=\frac{1}{x} \\
& x=-\frac{1}{2} \\
& y=\frac{1}{x}+2
\end{aligned}
$$

TaI

$$
f(x)=(x+4)(x-1)(2-x)
$$

crosses $x$ when $y=0$

$$
\begin{gathered}
0=(x+4)(x-1)(2-x) \\
x=-4 \quad x=1 \quad x=2
\end{gathered}
$$

crosses $y$ when $x=0$

$$
\begin{aligned}
y & =(4)(-1)(2) \\
& =-8
\end{aligned}
$$


b) $y=f(x+2)$

u' $\quad y=-f(x)$

8)

$$
f(x)=(x+3)(x-1)^{2}
$$

crosses $x$ when $y=0$

$$
\begin{array}{r}
0=(x+3)(x-1)^{2} \\
x=-3 \quad x=1
\end{array}
$$

crosses $y$ when $x=0$

$$
\begin{aligned}
y & =(3)(-1)^{2} \\
& =3
\end{aligned}
$$


b)

$$
\begin{aligned}
f(x+2) & =(x+2+3)(x+2-1)^{2} \\
& =(x+5)(x+1)^{2}
\end{aligned}
$$

