(1) $f(x) = (x+2)(x-5)(x-(3-2i))(x-(3+2i))$

(Recall that since $3-2i$ is a root, its complex conjugate $3+2i$ is also a root)

Now $(x-(3-2i))(x-(3+2i)) = (x-3+2i)(x-3-2i) =$

$x^2 - 3x - \cancel{2ix} - 3x + 9 + \cancel{6i} + \cancel{2ix} - \cancel{6i} - 4i^2 = x^2 - 6x + 9 - 4(-1) = x^2 - 6x + 9 + 4 =$

$x^2 - 6x + 13$, which has real coefficients.

So $\boxed{f(x) = (x+2)(x-5)(x^2-6x+13)}$

(2) $f(x) = d\,x(x-1)(x-3)$ $\boxed{f(x) = -5x(x-1)(x-3)}$

We need to find d using $f(2) = 10$

$10 = d\,2(2-1)(2-3)$

$10 = -2d \quad d = -5$

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

domain: Solve $x^2+x+1=0$ $x = \dfrac{-1 \pm \sqrt{1-4}}{2} = \dfrac{-1 \pm \sqrt{-3}}{2}$ no real solutions.

The denominator is never 0, so domain is $\boxed{(-\infty, \infty)}$

x-intercept $x-2=0$ $x=2$ $\boxed{(2,0)}$

y-intercept $f(0) = -2$ $\boxed{(0,-2)}$

Horizontal asymptote $\boxed{y=0}$ (because the degree of the numerator (1) is less than the degree of the denominator (2)).

Vertical asymptote $\boxed{\text{None}}$ (because the denominator is never zero)

(4) $f(x) = \dfrac{3x-9}{2-x}$

a) domain $2-x \neq 0$ $x \neq 2$ $\boxed{(-\infty,2) \cup (2,\infty)}$

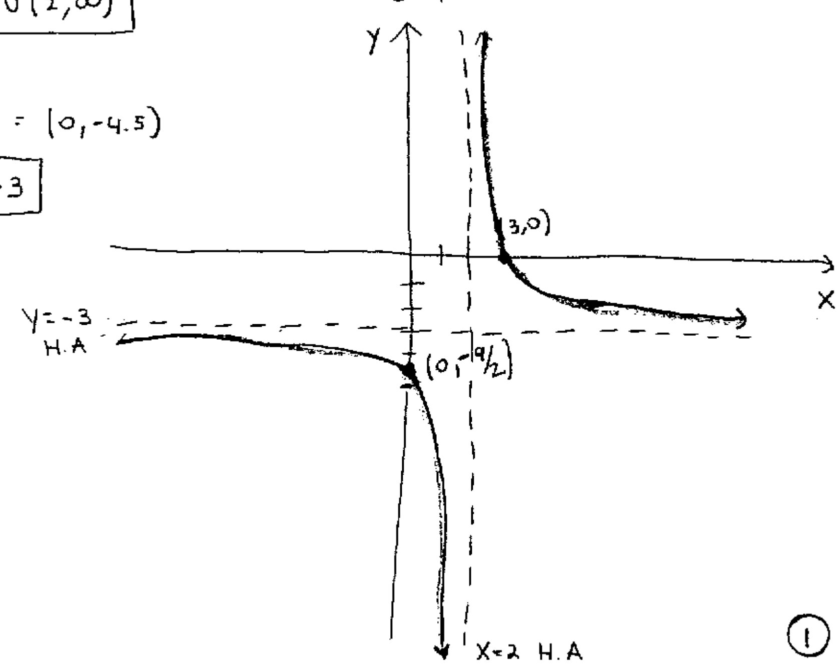
x-intercept $3x-9=0$ $x=3$ $\boxed{(3,0)}$

y-intercept $f(0) = -9/2$ $\boxed{(0,-9/2)} = (0,-4.5)$

Horizontal asymptote $y = \frac{3}{-1}$ $\boxed{y=-3}$

Vertical asymptote $\boxed{x=2}$

b) Graphing paper will be provided



c) Identify roots and V.A: $x=2$, $x=3$. Test a point in each interval.

NEGATIVE	POSITIVE	NEGATIVE
	2	3
$x=1$	$x=2.5$	$x=4$
$\frac{3(1)-9}{2-1}=-6<0$	$\frac{3(2.5)-9}{2-2.5}=3>0$	$\frac{3(4)-9}{2-4}=-\frac{3}{2}<0$

$\boxed{\text{Answer } (2,3]}$

(Notice that $x=2$ is not included since it is not in the domain)

⑤ $25-9x^2<0$

Identify roots: $25=9x^2$ $x^2=\frac{25}{9}$ $x=\pm\frac{5}{3}$ Test a point in each interval

NEGATIVE	POSITIVE	NEGATIVE
	$-5/3$	$5/3$
$x=-2$	$x=0$	$x=2$
$25-9(-2)^2=-11<0$	$25>0$	$25-9(2)^2=-11<0$

$\boxed{\text{Answer } \left(-\infty,-\frac{5}{3}\right)\cup\left(\frac{5}{3},\infty\right)}$

⑥

$$\begin{array}{r|l} & 2x^2+3x+6 \\ \hline x-1 & 2x^3+x^2+3x+5 \\ & -2x^3+2x^2 \\ \hline & 3x^2+3x+5 \\ & -3x^2+3x \\ \hline & 6x+5 \\ & -6x+6 \\ \hline & 11 \end{array}$$

$\boxed{\text{Answer } 2x^2+3x+6+\frac{11}{x-1}}$

or: Quotient $=2x^2+3x+6$

Remainder $=11$

⑦ From the graph of $f(x)$ (or a table) we "guess" that $x=-1$ is a root.

We check that $f(-1)=0$: $f(-1)=(-1)^3+7(-1)^2+13(-1)+7=-1+7-13+7=0$. So $x=-1$ is a root.

The other roots are not exact, so we use algebra.

Since $x=-1$ is a root, $x+1$ is a factor of $f(x)$,

$f(x)=(x+1)\,g(x)$. To find $g(x)$ we divide $f(x)$ by $x+1$ (notice that remainder must be zero)

$$\begin{array}{r|l} & x^2+6x+7 \\ \hline x+1 & x^3+7x^2+13x+7 \\ & -x^3-x^2 \\ \hline & 6x^2+13x+7 \\ & -6x^2-6x \\ \hline & 7x+7 \\ & -7x-7 \\ \hline & 0 \end{array}$$

$f(x)=(x+1)(x^2+6x+7)$

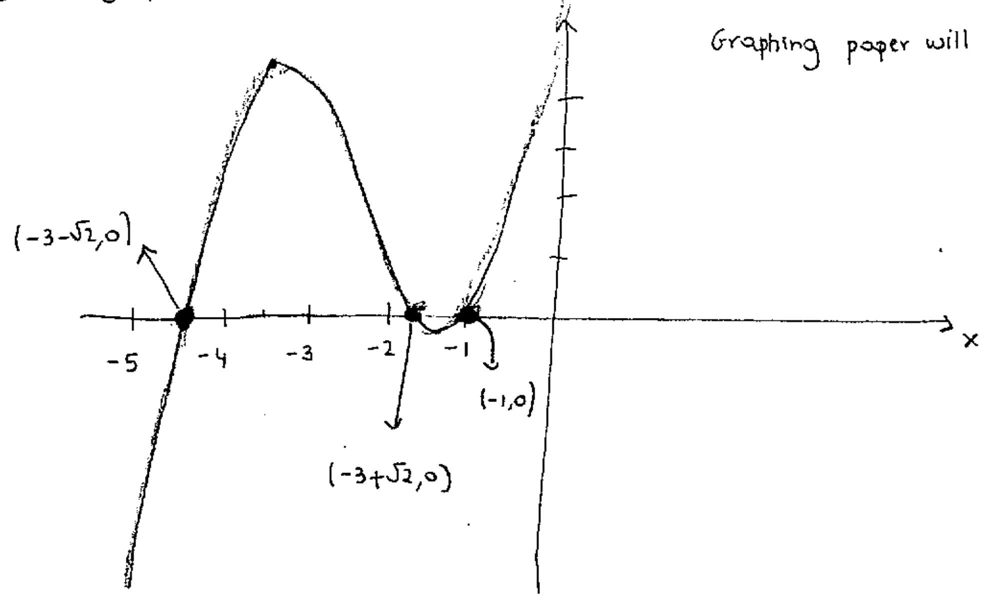
To find the other roots we solve $x^2+6x+7=0$ using the quadratic formula

$x^2+6x+7=0 \qquad x = \dfrac{-6 \pm \sqrt{36-28}}{2} = \dfrac{-6 \pm \sqrt{8}}{2} = \dfrac{-6 \pm 2\sqrt{2}}{2} = -3 \pm \sqrt{2}$

So the 3 roots of $f(x)$ are: $\boxed{x=-1,\ x=-3-\sqrt{2},\ x=-3+\sqrt{2}}$

For graphing purposes notice that $-3-\sqrt{2} \approx -4.4$ and $-3+\sqrt{2} \approx -1.6$

Graphing paper will be provided



⑧ $f(x) = \dfrac{x^2-36}{x-6}$

domain $\boxed{(-\infty, 6) \cup (6, \infty)}$

y-intercept $\boxed{(0,6)}$

x-intercepts $x^2-36=0 \quad x = \pm 6$ but $x=6$ is not in the domain, so the only x-intercept is $\boxed{(-6,0)}$

Since $\dfrac{(x-6)(x+6)}{(x-6)} = x+6$ $f(x)$ is the line $y = x+6$ with a hole at $x=6$

There are $\boxed{\text{no horizontal or vertical asymptotes.}}$

(9) $15x^2 + 22x - 5 \le 0$

Identify roots: $15x^2 + 22x - 5 = 0$

$$x = \frac{-22 \pm \sqrt{(22)^2 - 4(15)(-5)}}{30} = \frac{-22 \pm \sqrt{484 + 300}}{30} = \frac{-22 \pm \sqrt{784}}{30} =$$

$$\frac{-22 \pm 28}{30} \quad \frac{-22+28}{30} = \frac{6}{30} = \frac{1}{5} \qquad \frac{-22-28}{30} = \frac{-50}{30} = -\frac{5}{3}$$

Test a point in each interval:

POSITIVE	$-\frac{5}{3}$	NEGATIVE	$\frac{1}{5}$	POSITIVE
$x = -2$		$x = 0$		$x = 1$
$15(-2)^2 + 22(-2) - 5 =$		$-5 < 0$		$15 + 22 - 5 = 32 > 0$
$60 - 44 - 5 = 11 > 0$				

$\boxed{\text{Answer } \left[-\frac{5}{3}, \frac{1}{5}\right]}$