1) $z = 8\left(\cos\frac{\pi}{6} + i\sin\frac{\pi}{6}\right)$

$w = 3\left(\cos\frac{\pi}{2} + i\sin\frac{\pi}{2}\right)$

$\Rightarrow zw = 8.3\left(\cos\left(\frac{\pi}{6}+\frac{\pi}{2}\right) + i\sin\left(\frac{\pi}{6}+\frac{\pi}{2}\right)\right)$

$= 24\left(\cos\frac{4\pi}{6} + i\sin\frac{4\pi}{6}\right)$

$= 24\left(\cos\frac{2\pi}{3} + i\sin\frac{2\pi}{3}\right)$

2) $[2(\cos 75^\circ + i\sin 75^\circ)]^3 = 2^3\left(\cos(3.75^\circ) + i\sin(3.75^\circ)\right)$ (De Moivre)

$= 8\left(\cos 225^\circ + i\sin 225^\circ\right)$

Because $225^\circ = 180^\circ + 45^\circ$, we have

$\cos 225^\circ = -\cos 45^\circ = -\sqrt{2}/2$

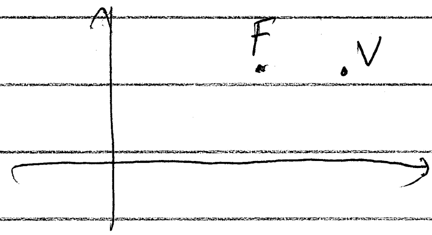
$\sin 225^\circ = -\sin 45^\circ = -\sqrt{2}/2$

Therefore,

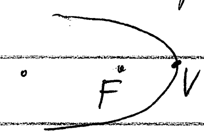
the result is $8\left(-\frac{\sqrt{2}}{2} - i\frac{\sqrt{2}}{2}\right) = -4\sqrt{2} - 4\sqrt{2}\,i$

3) vertex = $(8,6)$ and focus = $(3,6)$

- Draw these two points in the plane:



We see that the focus lies on the left of the vertex. Thus, the parabola is open left.



- The equation of the parabola looks like "$y^2 = \ldots$"

- Since $V = (8,6)$, it should have the form

$$(y-6)^2 = -4a(x-8)$$

the minus sign is because the parabola is open left.

- a is the distance from V to F, which is 5.

- Therefore the equation is $(y-6)^2 = -20(x-8)$.

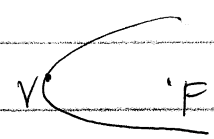
4) $(y+2)^2 = 12(x-4)$

- By setting both sides zero, we get $x=4$ and $y=-2$. Thus the vertex is $(4,-2)$.

- The distance between the vertex and the focus is $a = 12/4 = 3$.

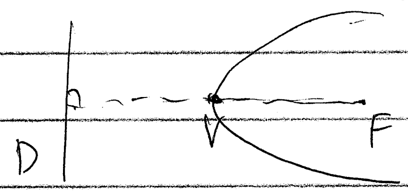
- Because the equation is of the form "$y^2 = \ldots$", the parabola is open left or right.

- Because we see the plus sign in front of 12, the parabola is open right.



- Therefore, $F = (4+3, -2) = (7, -2)$

- The directrix is obtained by taking the reflection of F with respect to V.



Therefore the equation of D is $x = 4 - 3 = 1$

In short,

$$\boxed{\begin{array}{l} V = (4,-2) \\ F = (7,-2) \\ D: x = 1 \end{array}}$$