1) $z = 6\left(\cos\frac{3\pi}{2} + i\sin\frac{3\pi}{2}\right)$

$w = 12\left(\cos\frac{5\pi}{6} + i\sin\frac{5\pi}{6}\right)$

$\Rightarrow zw = 6.12\left(\cos\left(\frac{3\pi}{2} + \frac{5\pi}{6}\right) + i\sin\left(\frac{3\pi}{2} + \frac{5\pi}{6}\right)\right)$

$= 72\left(\cos\frac{14\pi}{6} + i\sin\frac{14\pi}{6}\right)$

We see that $\frac{14\pi}{6} = \frac{12\pi + 2\pi}{6} = 2\pi + \frac{2\pi}{6} = 2\pi + \frac{\pi}{3}$

Therefore, $zw = 72\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)$

2) $[2(\cos 105^\circ + i\sin 105^\circ)]^3 \xrightarrow{\text{De Moivre}} 2^3\left(\cos(3.105^\circ) + i\sin(3.105^\circ)\right)$

$= 8(\cos 315^\circ + i\sin 315^\circ)$ (*)

Because $315^\circ = 360^\circ - 45^\circ$, we have

$\cos 315^\circ = \cos(360^\circ - 45^\circ) = \cos(-45^\circ) = \cos 45^\circ = \frac{\sqrt{2}}{2}$

↑ cosine is even

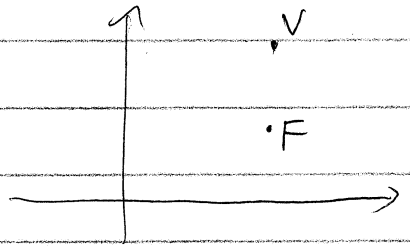
$\sin 315^\circ = \sin(360^\circ - 45^\circ) = \sin(-45^\circ) = -\sin 45^\circ = -\frac{\sqrt{2}}{2}$

↑ sine is odd

Therefore $(*) = 8\left(\frac{\sqrt{2}}{2} - i\frac{\sqrt{2}}{2}\right) = 4\sqrt{2} - i4\sqrt{2}$

3) vertex = (8, 7) and focus = (8, 3)

- Draw these two points on the plane:



We see that the focus lies below the vertex. Thus, the parabola is open down

- The equation of the parabola will have the form "$x^2 =$".

- Since V = (8, 7), it should have the form $(x-8)^2 = -4a(y-7)$

the minus sign is because the parabola is open down.

- a is the distance from V to F, which is 4.

- Therefore the equation is $(x-8)^2 = -16(y-7)$

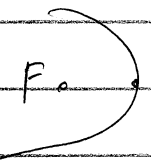
4) $(y+2)^2 = -16(x+1)$

- By setting both sides zero, we get $x = -1$ and $y = -2$. Thus the vertex is $(-1, -2)$.

- The distance between the vertex and the focus is $a = 16/4 = 4$.

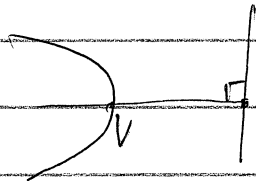
- Because the equation is of the form "$y^2 = $"; the parabola is open left or right.

- Because we see the minus sign before 16, the parabola is open left.



- Therefore, $F = (-1-4, -2) = (-5, -2)$

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



Therefore the equation of D is $x = -1 + \underbrace{4}_{a} = 3$

In short,

$V = (-1, -2)$
$F = (-5, -2)$
$D: x = 3$