Virtual Memory Problem

Consider a byte addressable Paging Virtual Memory system with virtual memory size of 4 GB and physical memory size of 1 GB. Page size is 4 KB. Each page table entry contains an additional 4 bits: valid (1 bit), dirty (1 bit) and protection (2 bits). What is the size of the page table in bytes?

Size of page table = No. of Virtual Pages x No. bits per entry

No. of Virtual Pages = Total VM/ Size of page = 4 GB/4 KB = $2^{20}$

No. of Physical Frames = Total PM/ Size of page = 4 GB/1 KB = $2^{18}$. Therefore number of bits to store frame number is 18.

No. of bits per entry = Frame bits + valid bit + dirty bit + protection bits

= $18 + 1 + 1 + 2 = 22$

Therefore, Size of Page Table = $2^{20} \times 22$ bits $\sim$3MBytes