Set 3 — Answer key

Mark your paper first, then read the working for anything you missed. Every answer was generated from subnet maths and checked independently.

1. Which network is 192.168.178.9/20 in?

   Answer: 192.168.176.0/20

   - /20 = 255.255.240.0: interesting octet is the 3rd (240). Block = 256 − 240 = 16.
   - 178 ÷ 16 = 11 r2 → block starts at 176, next block at 192.
   - Network 192.168.176.0, broadcast 192.168.191.255 (octets to the right: 0 on the network, 255 on the broadcast).

   `Check it: https://subnetcalculator.dev/?ip=192.168.178.9&cidr=20`

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2. Mask 255.255.252.0: which octet does the block size count in?

   Answer: 3rd octet (block 4)

   - The first octet that isn't 255 is the 3rd (252): block 256 − 252 = 4.

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3. 192.168.123.225/28: find the network, broadcast and usable range.

   Answer: Network 192.168.123.224 · broadcast 192.168.123.239 · usable 192.168.123.225–192.168.123.238

   - /28 = 255.255.255.240: interesting octet is the 4th (240). Block = 256 − 240 = 16.
   - 225 ÷ 16 = 14 r1 → block starts at 224, next block at 240.
   - Network 192.168.123.224, broadcast 192.168.123.239.
   - Usable 192.168.123.225–192.168.123.238 (14 hosts).

   `Check it: https://subnetcalculator.dev/?ip=192.168.123.225&cidr=28`

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4. Which network is 10.46.106.77/20 in?

   Answer: 10.46.96.0/20

   - /20 = 255.255.240.0: interesting octet is the 3rd (240). Block = 256 − 240 = 16.
   - 106 ÷ 16 = 6 r10 → block starts at 96, next block at 112.
   - Network 10.46.96.0, broadcast 10.46.111.255 (octets to the right: 0 on the network, 255 on the broadcast).

   `Check it: https://subnetcalculator.dev/?ip=10.46.106.77&cidr=20`

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5. Broadcast address for 10.132.78.241/19?

   Answer: 10.132.95.255

   - /19 = 255.255.224.0: interesting octet is the 3rd (224). Block = 256 − 224 = 32.
   - 78 ÷ 32 = 2 r14 → block starts at 64, next block at 96.
   - Network 10.132.64.0, broadcast 10.132.95.255 (octets to the right: 0 on the network, 255 on the broadcast).
   - Trap: the 4th octet of the broadcast is 255, not the block edge.

   `Check it: https://subnetcalculator.dev/?ip=10.132.78.241&cidr=19`

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6. Block size (magic number) for /22?

   Answer: 4 (in the 3rd octet)

   - /22 = 255.255.252.0. Interesting octet: 3rd (252).
   - 256 − 252 = 4.

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7. Smallest prefix that fits 400 hosts?

   Answer: /23 (255.255.254.0, 510 usable)

   - 400 hosts + 2 (network and broadcast) = 402 addresses.
   - Next power of two: 512 = 9 host bits → /23 (510 usable).

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8. Which network is 10.217.218.18/26 in?

   Answer: 10.217.218.0/26

   - /26 = 255.255.255.192: interesting octet is the 4th (192). Block = 256 − 192 = 64.
   - 18 ÷ 64 = 0 r18 → block starts at 0, next block at 64.
   - Network 10.217.218.0, broadcast 10.217.218.63.

   `Check it: https://subnetcalculator.dev/?ip=10.217.218.18&cidr=26`

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9. Subnet mask for /21?

   Answer: 255.255.248.0

   - /21 = 21 one-bits: 2 full octet(s) of 255, then 5 bit(s) = 248 in the 3rd octet.

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10. 10.37.148.50/28: find the network, broadcast and usable range.

    Answer: Network 10.37.148.48 · broadcast 10.37.148.63 · usable 10.37.148.49–10.37.148.62

    - /28 = 255.255.255.240: interesting octet is the 4th (240). Block = 256 − 240 = 16.
    - 50 ÷ 16 = 3 r2 → block starts at 48, next block at 64.
    - Network 10.37.148.48, broadcast 10.37.148.63.
    - Usable 10.37.148.49–10.37.148.62 (14 hosts).

    `Check it: https://subnetcalculator.dev/?ip=10.37.148.50&cidr=28`

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11. How many usable hosts in a /23?

    Answer: 510

    - 9 host bits: 2^9 = 512 addresses − 2 = 510.

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12. Which network is 172.25.12.249/23 in?

    Answer: 172.25.12.0/23

    - /23 = 255.255.254.0: interesting octet is the 3rd (254). Block = 256 − 254 = 2.
    - 12 ÷ 2 = 6 r0 → block starts at 12, next block at 14.
    - Network 172.25.12.0, broadcast 172.25.13.255 (octets to the right: 0 on the network, 255 on the broadcast).

    `Check it: https://subnetcalculator.dev/?ip=172.25.12.249&cidr=23`

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13. Smallest prefix that fits 1,000 hosts?

    Answer: /22 (255.255.252.0, 1,022 usable)

    - 1,000 hosts + 2 (network and broadcast) = 1,002 addresses.
    - Next power of two: 1,024 = 10 host bits → /22 (1,022 usable).

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14. Broadcast address for 172.18.99.153/19?

    Answer: 172.18.127.255

    - /19 = 255.255.224.0: interesting octet is the 3rd (224). Block = 256 − 224 = 32.
    - 99 ÷ 32 = 3 r3 → block starts at 96, next block at 128.
    - Network 172.18.96.0, broadcast 172.18.127.255 (octets to the right: 0 on the network, 255 on the broadcast).
    - Trap: the 4th octet of the broadcast is 255, not the block edge.

    `Check it: https://subnetcalculator.dev/?ip=172.18.99.153&cidr=19`

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15. How many usable hosts in a /22?

    Answer: 1,022

    - 10 host bits: 2^10 = 1,024 addresses − 2 = 1,022.

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16. 192.168.128.82/21: find the network, broadcast and usable range.

    Answer: Network 192.168.128.0 · broadcast 192.168.135.255 · usable 192.168.128.1–192.168.135.254

    - /21 = 255.255.248.0: interesting octet is the 3rd (248). Block = 256 − 248 = 8.
    - 128 ÷ 8 = 16 r0 → block starts at 128, next block at 136.
    - Network 192.168.128.0, broadcast 192.168.135.255 (octets to the right: 0 on the network, 255 on the broadcast).
    - Usable 192.168.128.1–192.168.135.254 (2,046 hosts).

    `Check it: https://subnetcalculator.dev/?ip=192.168.128.82&cidr=21`

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17. 192.168.8.226/20: find the network, broadcast and usable range.

    Answer: Network 192.168.0.0 · broadcast 192.168.15.255 · usable 192.168.0.1–192.168.15.254

    - /20 = 255.255.240.0: interesting octet is the 3rd (240). Block = 256 − 240 = 16.
    - 8 ÷ 16 = 0 r8 → block starts at 0, next block at 16.
    - Network 192.168.0.0, broadcast 192.168.15.255 (octets to the right: 0 on the network, 255 on the broadcast).
    - Usable 192.168.0.1–192.168.15.254 (4,094 hosts).

    `Check it: https://subnetcalculator.dev/?ip=192.168.8.226&cidr=20`

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18. Block size (magic number) for /21?

    Answer: 8 (in the 3rd octet)

    - /21 = 255.255.248.0. Interesting octet: 3rd (248).
    - 256 − 248 = 8.

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19. Prefix length for mask 255.255.254.0?

    Answer: /23

    - 255.255.254.0: 2 × 255 = 16 bits, plus 254 = 7 bit(s) → /23.

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20. VLSM: split 172.24.118.0/23 for 145, 59, 2 hosts, largest first. Which subnet does the 59-host LAN get?

    Answer: 172.24.119.0/26

    - Largest first: 145, 59, 2.
    - 145 → /24 (block 256); 59 → /26 (block 64); 2 → /30 (block 4).
    - Place each on the next free aligned address in 172.24.118.0/23: 172.24.118.0/24, 172.24.119.0/26, 172.24.119.64/30.

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