

Base Conversion Exercises



*This worksheet is designed to give you practice performing base conversions between **decimal** (base-10), **binary** (base-2), **octal** (base-8), and **hexadecimal** (base-16). It contains a problems that range from basic base conversions to more complex challenge problems. To check your answers, you can use [rapidtables.com](https://www.rapidtables.com). They have many different calculators depending on the problem that you are trying to solve, so make sure you pick the right one.*

Binary

1. Convert 248_{10} to **base-2**.
2. Convert 10101011101_2 to **base-10**.
3. Convert 0100_2 to **base-10**.
4. Convert 210_2 to **base-10**.
5. Convert 098765_{10} to **base-2**.

Octal

1. Convert 193_{10} to **base-8**.
2. Convert 127_8 to **base-10**.
3. Convert 100_2 to **base-8**.
4. Convert 820_8 to **base-2**.
5. Convert 11101011_2 to **base-8**.

Hexadecimal

1. Convert 193_{10} to **base-16**.
2. Convert $1A2_{16}$ to **base-10**.
3. Convert 0110110_{16} to **base-2**.

4. Convert 820_{16} to **base-2**.
5. Convert 122_8 to **base-16**.
6. Convert AEA_{16} to **base-8**.

Challenge Problems

*Give these a shot once you've done the other problems on the worksheet (Disclaimer: you **do not** have to know these problems for the AP exam, but they may help with strengthening your overall understanding)*

1. Can you come up with a rule to find powers of 2 in binary? In other words, give a binary number (e.g. 10101001_2) determine if it is a power of 2. This can be trivially by converting the number to decimal and just stating whether or not it is a power of 2, but try and do this by only looking at the number's digits.
2. Using the same logic as the previous question, can you come up with a rule to conclude whether an octal number is a power of 8 based on its digits?
3. Find the sum of 10101011_2 and $C3F14_{16}$ and give your result in hexadecimal.
4. If you completed the previous question by adding the converting the two numbers to decimal, then adding them, and converting back to hexadecimal, try finding the result without changing the numbers to base-10. Instead, only use binary and hexadecimal to find your answer
5. Find the difference between $C3F14_{16}$ and 10101011_2 and give your result in octal.
6. If you completed the previous question by adding the converting the two numbers to decimal, then subtracting them, and converting to octal, try finding the result without changing the numbers to base-10. Instead, only use binary and hexadecimal to find your answer. (Hint: if carrying during subtraction is difficult for you, think back to subtraction in decimal and generalize this process to other bases based on what you know)