Overview

In this unit your students should:

- find out how an op-amp can be made into a non-inverting amplifier
- find out how an op-amp can be made into an inverting amplifier
- understand that negative feedback is used to make op-amps into amplifiers
- learn how to calculate the voltage gain of op-amp amplifiers

This should not require more than 3 hours of class time.

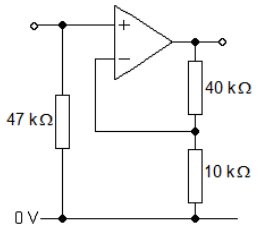
Hour	Suggested Activity
1	Launch your students straight into the **Non-inverting amplifier** practical. Students who finish with plenty of time to spare could be required to repeat the experiment with a feedback resistor of 10 kΩ. Ask them to answer question 1 on page 98 of the text book before the next session.
2	Launch your students straight into the **Inverting amplifier** practical. Students who finish with plenty of time to spare could be required to repeat the experiment with a feedback resistor of 10 kΩ. Ask them to answer question 2 on page 98 of the text book before the next session.
3	Get students to answer both pages of the **Known Gain** exercises. Then get them to answer question 3 on page 98 of the text book. Discuss their answers to question 3 on page 98. Ask them to study **6.4** before the next session.

Model Answers

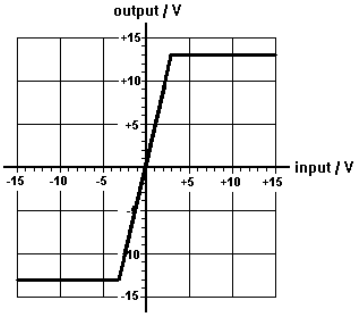
1 (a) $G = 1 + R_f/R_d = 5$, so $R_f/R_d = 4$

Let $R_d = 10\ k\Omega$.

Then $R_f = 4 \times 10 \times 10^3 = 4.0 \times 10^4\ \Omega$ or $40\ k\Omega$



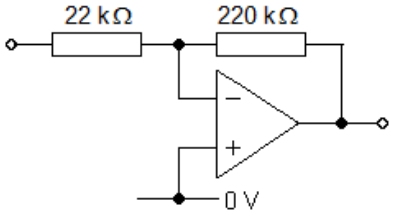
(b)



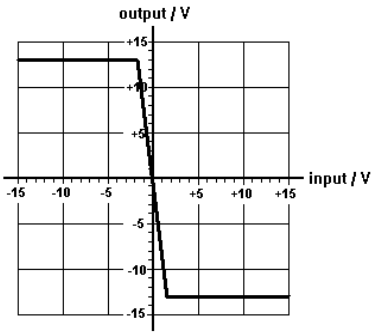
2 (a) $G = -R_f/R_{in}$

$-10 = -R_f / 22 \times 10^3$

$R_f = 10 \times 22 \times 10^3 = 2.2 \times 10^5\ \Omega$



(b)



3 (a) A resistor connects the output to the inverting input.

(b) Negative feedback forces the op-amp output to a voltage such that the voltage at both inputs is the same.

(c) A linear amplifier has a straight line for its transfer characteristic. This means that the output signal has exactly the same shape as the input signal.

(d) For an inverting amplifier, $G = -R_f/R_{in}$. For a non-inverting amplifier, $G = 1+R_f/R_d$.

(e) Large input signals result in saturation at the output, as the signal there cannot go above +13 V or below -13 V. This flattens the top and bottom of the output waveform, distorting it.