

4) Find the values of  $c$  and  $d$  so that this function will be continuous.

$$f(x) = \begin{cases} x & \text{if } x \leq -1 \\ cx + d & \text{if } -1 < x < 2 \\ -5x^2 & \text{if } x \geq 2 \end{cases}$$

If  $f(x)$  is to be continuous then the left and right hand limits at  $x=-1$  must be equal and the left and right limits at  $x=2$  must be equal.

$$\lim_{x \rightarrow -1^-} f(x) = \lim_{x \rightarrow -1^+} f(x)$$

$$\lim_{x \rightarrow -1^-} x = \lim_{x \rightarrow -1^+} cx + d$$

$$\underline{-1 = -c + d}$$

$$\lim_{x \rightarrow 2^-} f(x) = \lim_{x \rightarrow 2^+} f(x)$$

$$\lim_{x \rightarrow 2^-} cx + d = \lim_{x \rightarrow 2^+} -5x^2$$

$$\underline{2c + d = -20}$$

Now solve the two equations for  $c$  and  $d$ .

$$-1 = -c + d \rightarrow d = c - 1$$

$$2c + (c - 1) = -20$$

$$3c - 1 = -20$$

$$3c = -19$$

$$c = -\frac{19}{3} \rightarrow d = -\frac{22}{3}$$