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Tor

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Let  $R$  be a ring with multiplicative identity. Let  $M$  be a  $(\ )$  module over  $R$ . We may assume there exists an exact sequence  $P_*$ :

$$\dots\dots\dots \rightarrow P_2 \rightarrow P_1 \rightarrow P_0$$

with the  $P_n$  projective and the cokernel of the last map  $M$ . Given  $M$ , this sequence is unique up to chain homotopy. Hence we may make the following definitions.

For a  $(\ )$   $R$ - module  $A$  we may define

$$Ext_R^n(M, A) = H^n(P_*; A)$$

For a (left)  $R$ - module  $A$  we may define

$$Tor_R^n(M, A) = H_n(P_*; A)$$