CENTRAL DIFFERENCE:

Formula:

Y(x)=$y_o + \frac{(\Delta y_o + \Delta y_{-1})p}{2} + \frac{p^2}{2!}\Delta^2 y_{-1} + \frac{p(p^2-1)}{3!}(\Delta^3 + \Delta^3 y_{-2}) + \frac{p^2(p^2-1^2)}{4!}\Delta^4 y_{-2}$

Example:

Use central interpolation to find the value of y when x=35 from the following table

x	20	30	40	50
y	512	439	346	243

Let x_0=40

x	y	Δy	$\Delta^2 y$	$\Delta^3 y$
x_{-2}=20	y_{-2}=512			
		Δy_{-2}=-73		
x_{-1}=30	y_{-1}=439		$\Delta^2 y_2$=-20	
		Δy_{-1}= -93		$\Delta^3 y_2$=10
x_0=40	y_0=346		$\Delta^2 y_1$=-10	
		Δy_0= -103		
x_1=50	y_1=243			

Given

X=35, x_o=40, h=10

$$p = \frac{x - x_o}{h}$$

=$\frac{35-40}{10}$

= 0.5

Putting values in formula

$$y(35) = 346 + (0.5)\left(\frac{-103 - 93}{2}\right) + \frac{(-0.5)^2}{2!}(-10)$$

y (35) =346+49-1.525

y (35)=393.75