

# Finite Difference Method for Poisson Eqn

Example:

$$u(x) = x^2$$

Approximate  $u'(1)$

$$u'(x) = \frac{u(x+h) - u(x)}{h}$$

Forward difference

h	$u'(1) \approx$	error
0.1	2.1	0.1
0.01	2.01	0.01
0.001	2.001	0.001

# Finite Difference Method for Poisson Equation

Example:

$$u(x) = x^2$$

Approximate  $u'(1)$

$$u'(x) = \frac{u(x) - u(x-h)}{h}$$

Backward difference

h	$u'(1) \approx$	error
0.1	1.9	0.1
0.01	1.99	0.01
0.001	1.999	0.001

**Observation????**

# Finite Difference Method for Poisson Equation

Example:

$$u(x) = x^3$$

Approximate  $u'(1)$

$$u'(x) = \frac{u(x+h) - u(x-h)}{2h}$$

Central difference

h	$u'(1) \approx$	error
0.1	3.01	1e-2
0.01	3.0001	1e-4
0.001	3.000001	1e-6

**Observation????**

# Finite Difference Method for Poisson Equation

Example:

$$u(x) = x^3$$

Approximate  $u'(1)$

h	Error Forward	Error Backward	Error central
0.1	1e-1	1e-1	1e-2
0.01	1e-2	1e-2	1e-4
0.001	1e-3	1e-3	1e-6

**Observation???**