EXAM   GRAPHICS

1.   3D uniform grid → consecutive points are 8 units apart

consider point p (13, 19, 25)   and   q (17, 27, 15)   multiples of 8

p (13, 19, 25)   q (17, 27, 15)
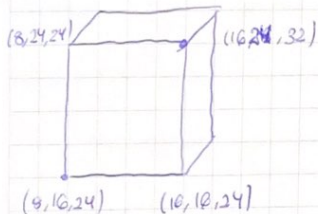
13 = 8 + 5   17 = 16 + 1
19 = 16 + 9   27 = 24 + 3
25 = 24 + 1   15 = 8 + 7

For p: For q:

(8,24,24)   (16,24,32)   (16,32,8)   (24, 32, 16)

(8,16,24)   (16,16,24)   (16,24,8)   (24,24,8)
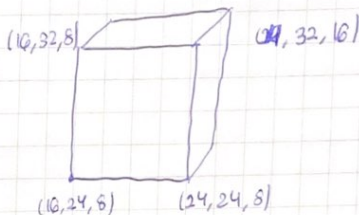
$V_{i,j,k} = (8, 16, 24)$ $V_{i,j,k} = (16, 24, 8)$
$V_{i+1,j,k} = (16, 16, 24)$ $V_{i+1,j,k} = (24, 24, 8)$
$V_{i,j+1,k} = (8, 24, 24)$ $V_{i,j+1,k} = (24, 32, 8)$
$V_{i,j,k+1} = (8, 16, 32)$ $V_{i,j,k+1} = (16, 24, 16)$
$V_{i+1,j+1,k} = (16, 24, 24)$ $V_{i+1,j+1,k} = (24, 32, 8)$
$V_{i+1,j,k+1} = (16, 16, 32)$ $V_{i+1,j,k+1} = (24, 24, 16)$
$V_{i,j+1,k+1} = (8, 24, 32)$ $V_{i,j+1,k+1} = (16, 32, 16)$
$V_{i+1,j+1,k+1} = (16, 24, 32)$ $V_{i+1,j+1,k+1} = (24, 32, 16)$

trilinear interpolation the value of μ-a(p)

13 |8   normalization
 5 1
                   → x = 5/8

19 |8
 3 2   y = 3/8

25 |8
 1 3   z = 1/8

$\mu\text{-}a(p) = (1-x)(1-y)(1-z)f(v_{i,j,k}) + (1-x)(1-y)z f(v_{i,j,k+1}) +$

$x(1+y)(1-z)f(v_{i+1,j,k}) + x(1-y)z f(v_{i+1,j,k+1}) + (1-x)y(1-z)$

$\cdot f(v_{i,j+1,k}) + (1-x)yz f(v_{i,j+1,k+1}) + xy(1-z)f(v_{i+1,j+1,k}) +$

$xyz f(v_{i+1,j+1,k+1})$

$\mu a(p) = \left(1-\frac{5}{8}\right)\left(1-\frac{3}{8}\right)\left(1-\frac{1}{8}\right)\cdot 0.01 + \left(1-\frac{5}{8}\right)\left(1-\frac{3}{8}\right)\cdot\frac{1}{8}\cdot 0.005 + \frac{5}{8}\left(1-\frac{3}{8}\right)\left(1-\frac{1}{8}\right)\cdot 0.02$

$+ \frac{5}{8}\cdot\left(1-\frac{3}{8}\right)\cdot\frac{1}{8}\cdot 0.025 + \left(1-\frac{5}{8}\right)\frac{3}{8}\left(1-\frac{1}{8}\right)\cdot 0.015 + \left(1-\frac{5}{8}\right)\frac{3}{8}\cdot\frac{1}{8}\cdot 0.04$

$+ \frac{5}{8}\cdot\frac{3}{8}\left(1-\frac{1}{8}\right)\cdot 0.03 + \frac{5}{8}\cdot\frac{3}{8}\cdot\frac{1}{8}\cdot 0.035 = 0.01998$