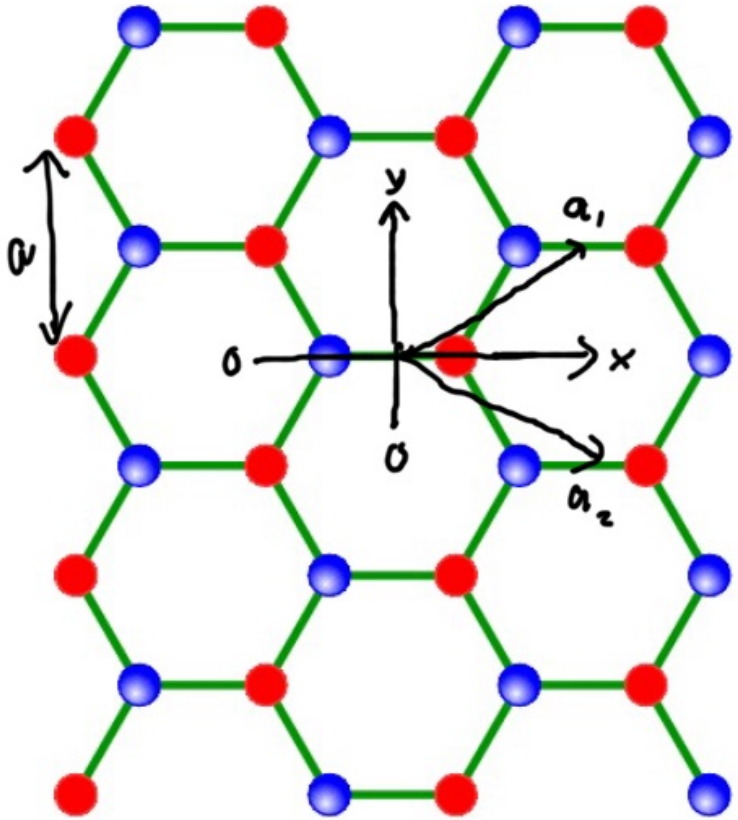
GRAPHENE: Real Space



DRAW A CHOICE OF a_1, a_2!

Basis = $\left\{\left(\pm\frac{1}{\sqrt{3}}, 0\right)\right\}$

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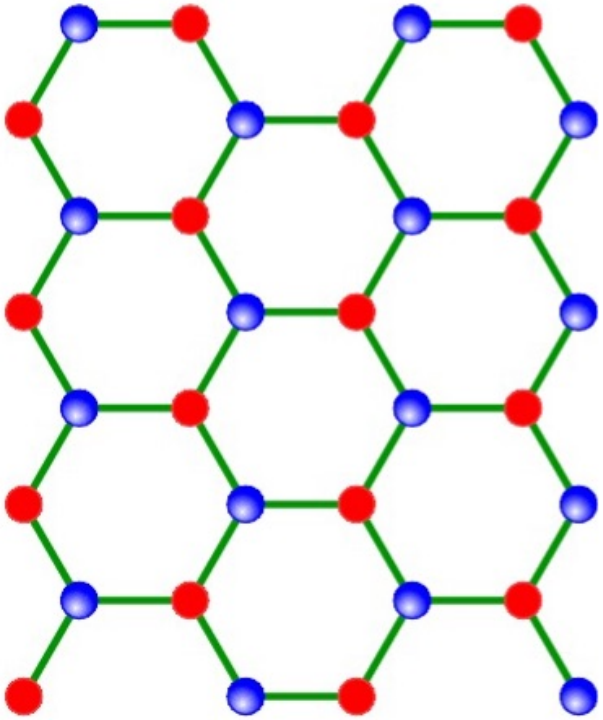
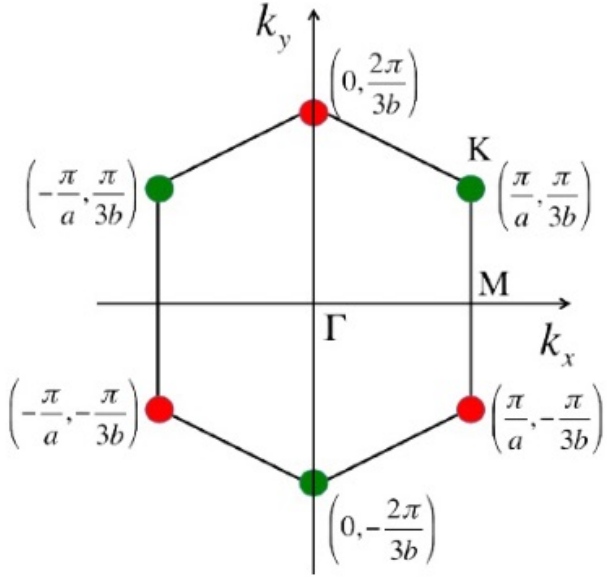
GRAPHENE RECIPROCAL SPACE:





1st BRILLIOUN ZONE

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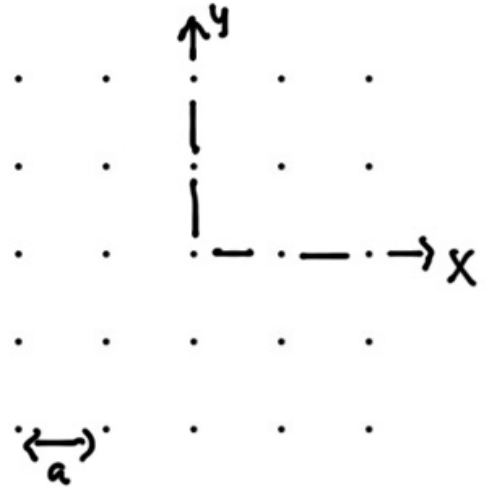
2D Square lattice:



Real space

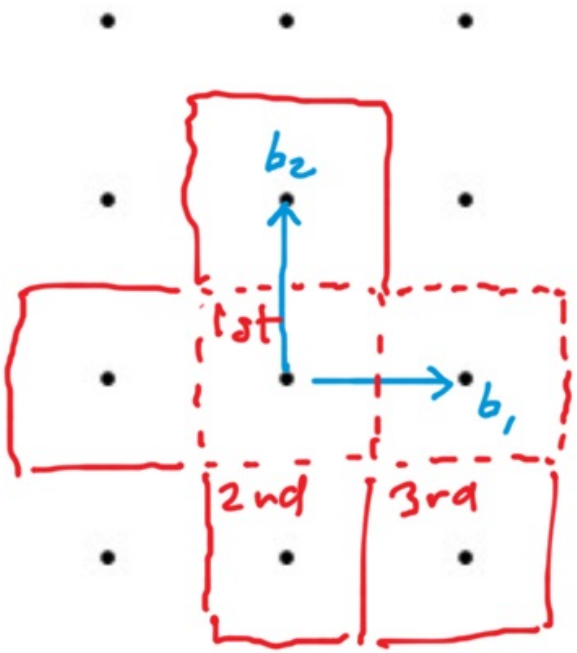
$a_1 = (1,0)\, a$

$a_2 = (0,1)\, a$

Reciprocal space

$b_1 = (1,0)\, \frac{2\pi}{a}$

$b_2 = (0,1)\, \frac{2\pi}{a}$



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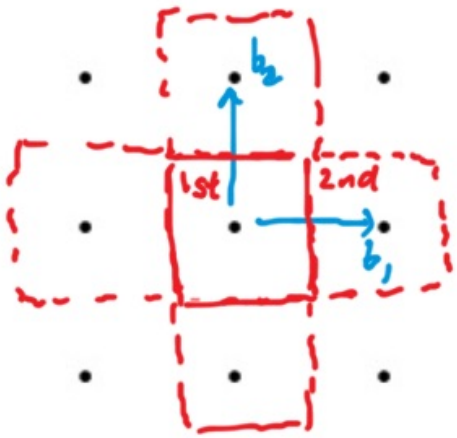
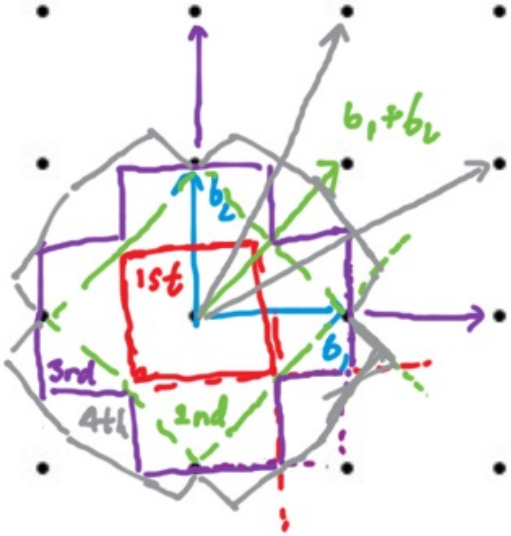
NOTE ON 2nd, 3rd ... BRILLIOUN ZONES:





IN ELECTRONIC BAND STRUCTURE LITERATURE REFERENCE TO "2nd BRILLIOUN ZONE" IS HAVING THE MEANING AS SHOWN ABOUE. THIS PROBABLY USEFUL JARGON.

THIS IS THE STRICT TEXT BOOK DEFINITION OF HOW TO CONSTRUCT HIGHER ORDER BRILLIOUN ZONE.
THIS IS THE SCHEME TO USE FOR EXERCISE 4 (Sheet 2).

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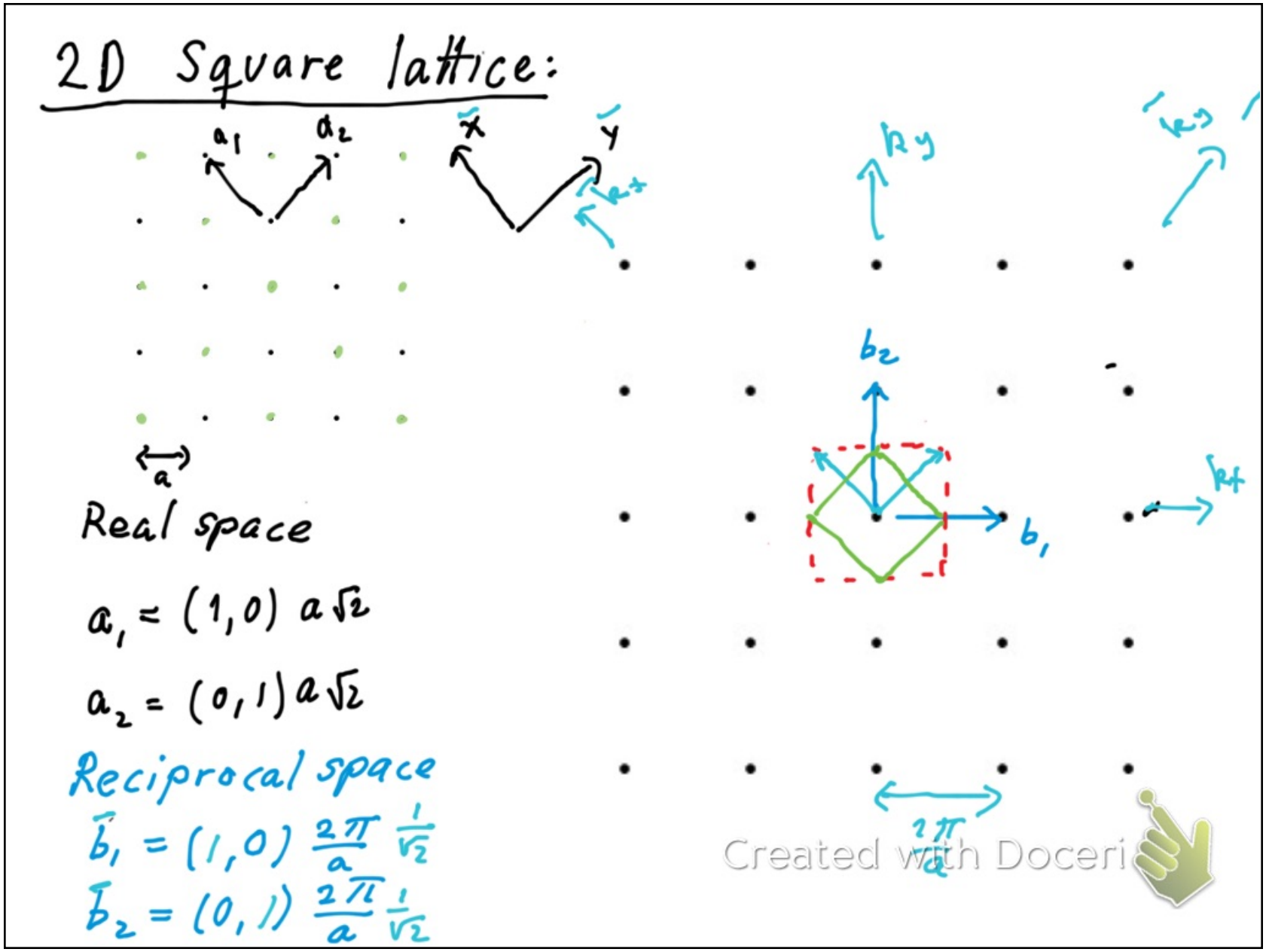
2D Square lattice:
a_1
a_2
$\vec{x}$
$\vec{y}$
k_y
k_x
b_2
b_1
k_x
a
Real space
$a_1 = (1,0)\, a\sqrt{2}$
$a_2 = (0,1)\, a\sqrt{2}$
Reciprocal space
$\vec{b}_1 = (1,0)\, \frac{2\pi}{a} \frac{1}{\sqrt{2}}$
$\vec{b}_2 = (0,1)\, \frac{2\pi}{a} \frac{1}{\sqrt{2}}$
$\frac{2\pi}{a}$
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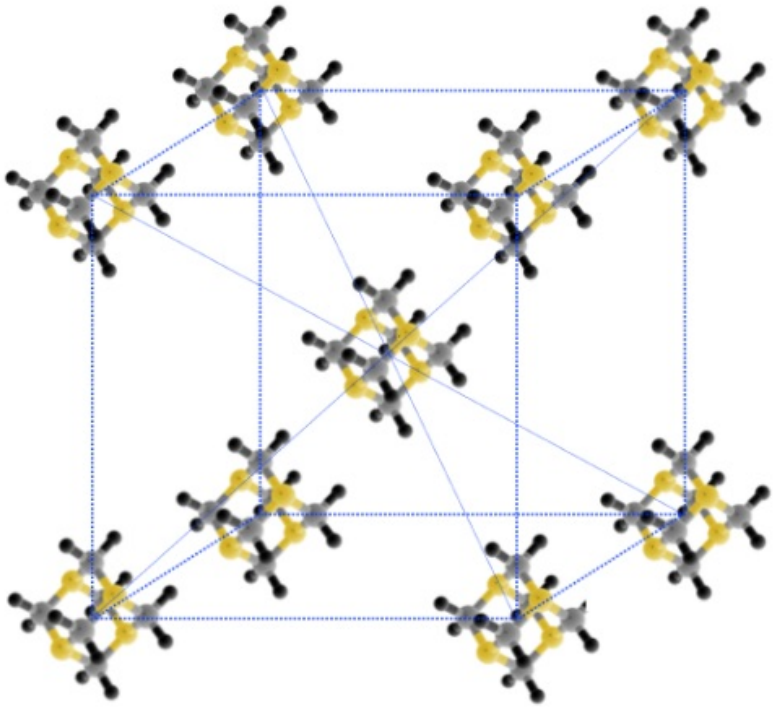
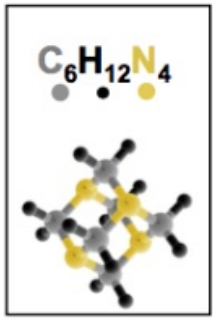
COMPLICATED EXAMPLE:





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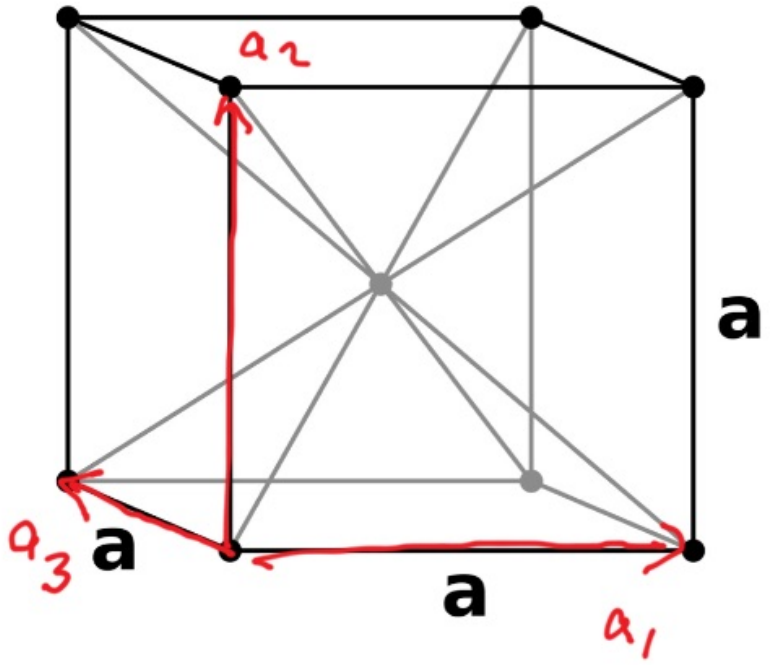
BCC CRYSTAL STRUCTURE:



$$BASIS = \{(0,0,0); (1,1,1)\frac{a}{2}\}$$

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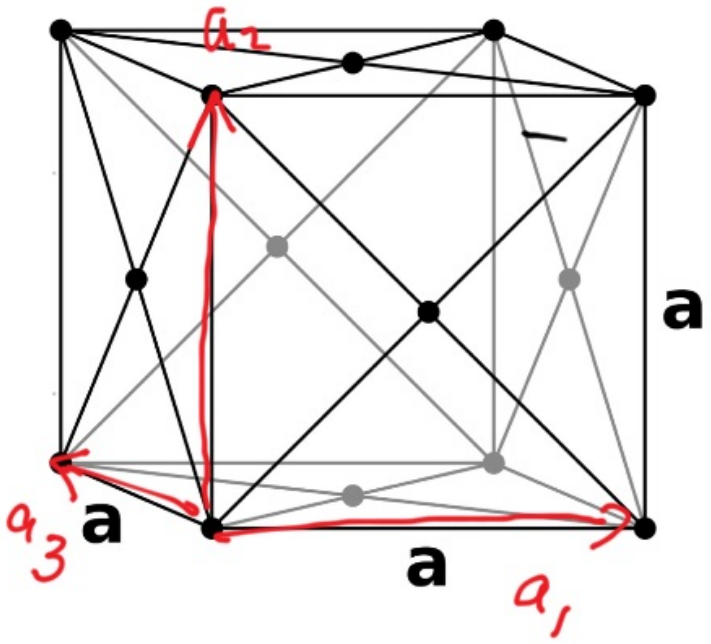
FCC CRYSTAL STRUCTURE:



BASIS = { (0,0,0)
(1,1,0) $\frac{a}{2}$
(1,0,1) $\frac{a}{2}$
(0,1,1) $\frac{a}{2}$ }

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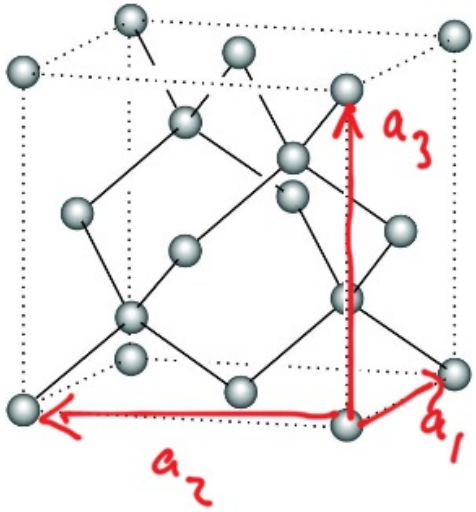
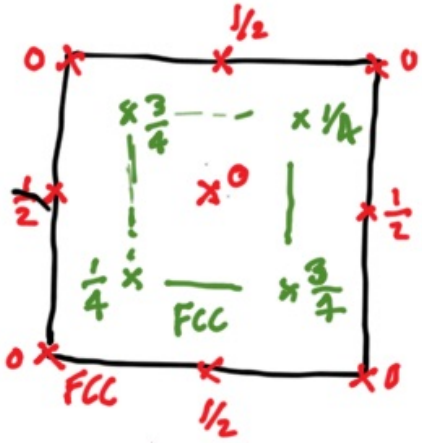
DIAMOND STRUCTURE:





BASIS = { (0,0,0)
(1,1,0) $\frac{a}{2}$
(1,0,1) $\frac{a}{2}$
(0,1,1) $\frac{a}{2}$
(1,1,1) $\frac{a}{4}$
(3,3,1) $\frac{a}{4}$
(3,1,3) $\frac{a}{4}$
(1,3,3) $\frac{a}{4}$ }

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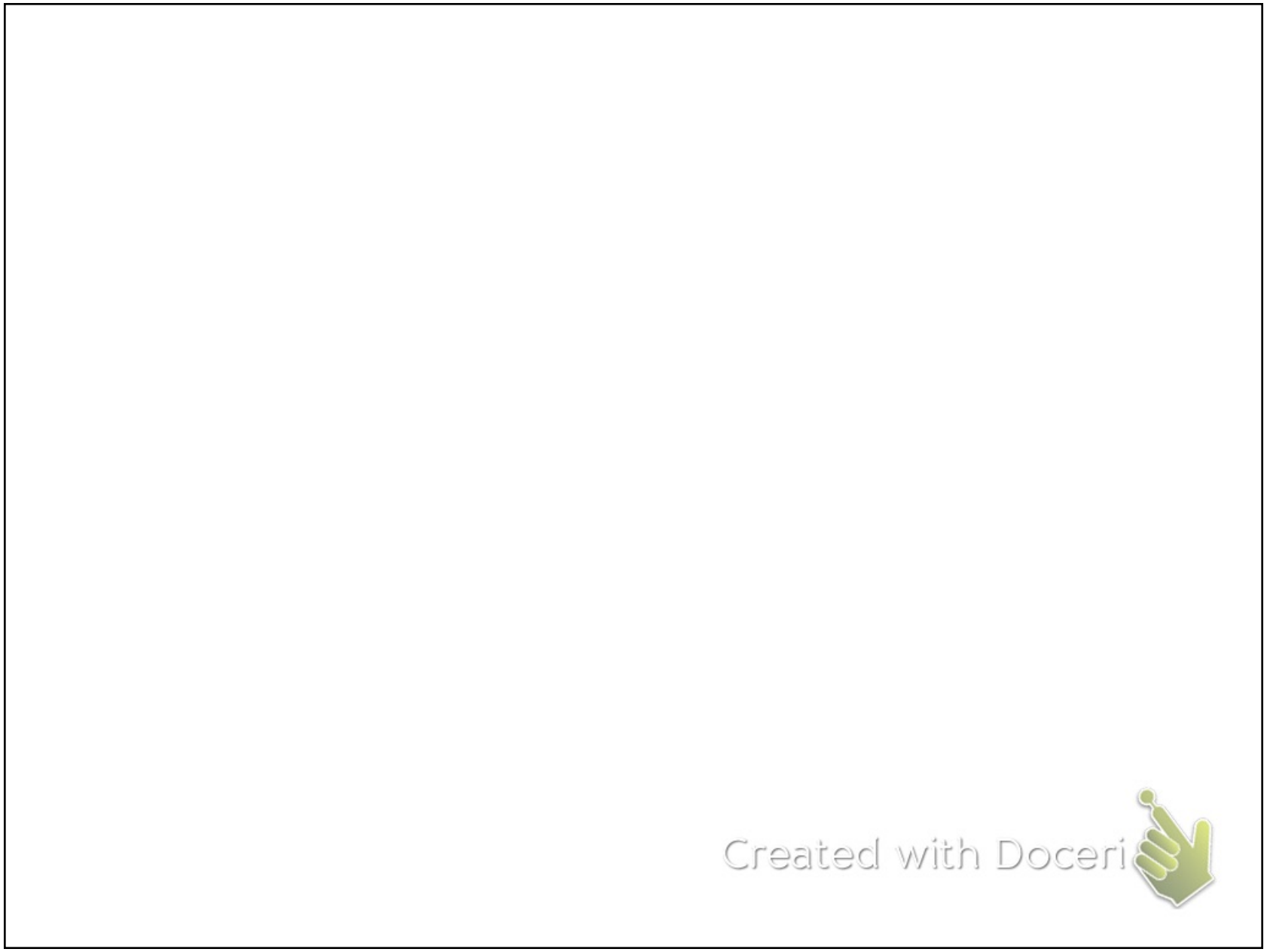
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