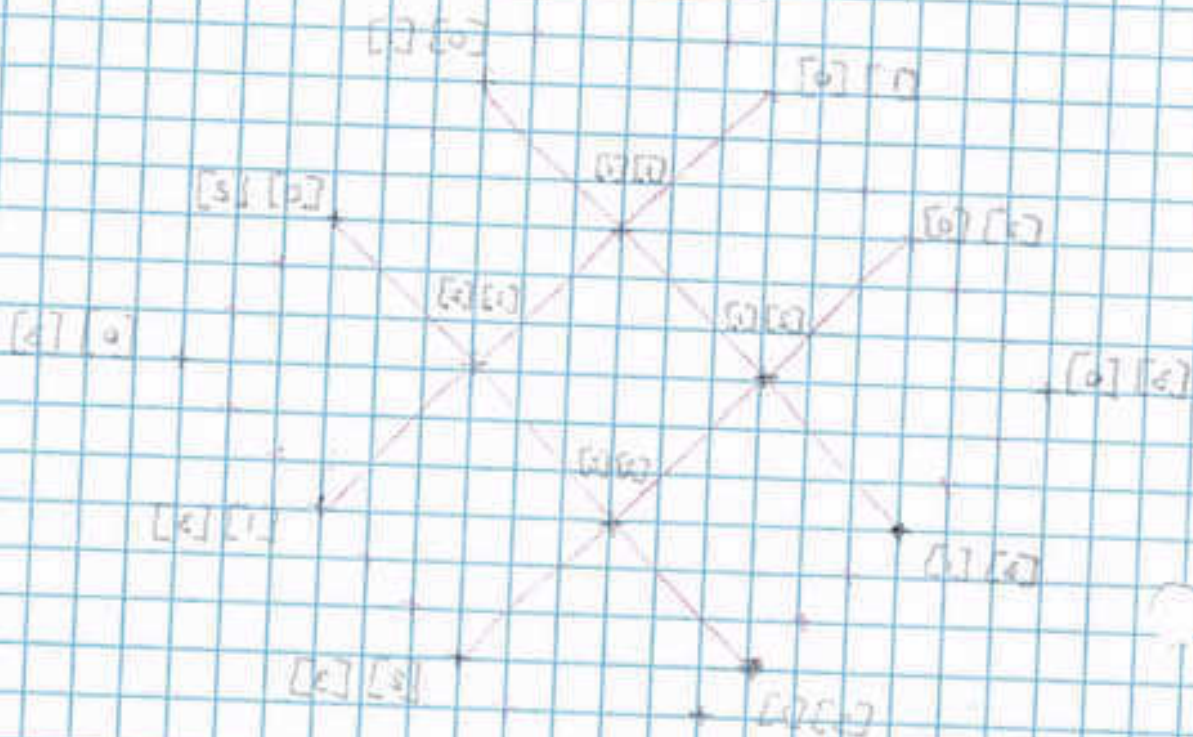


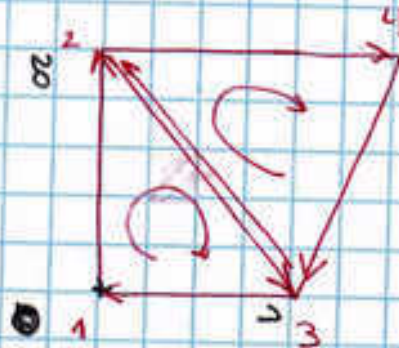
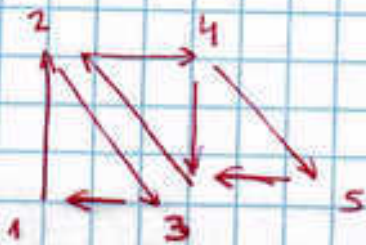
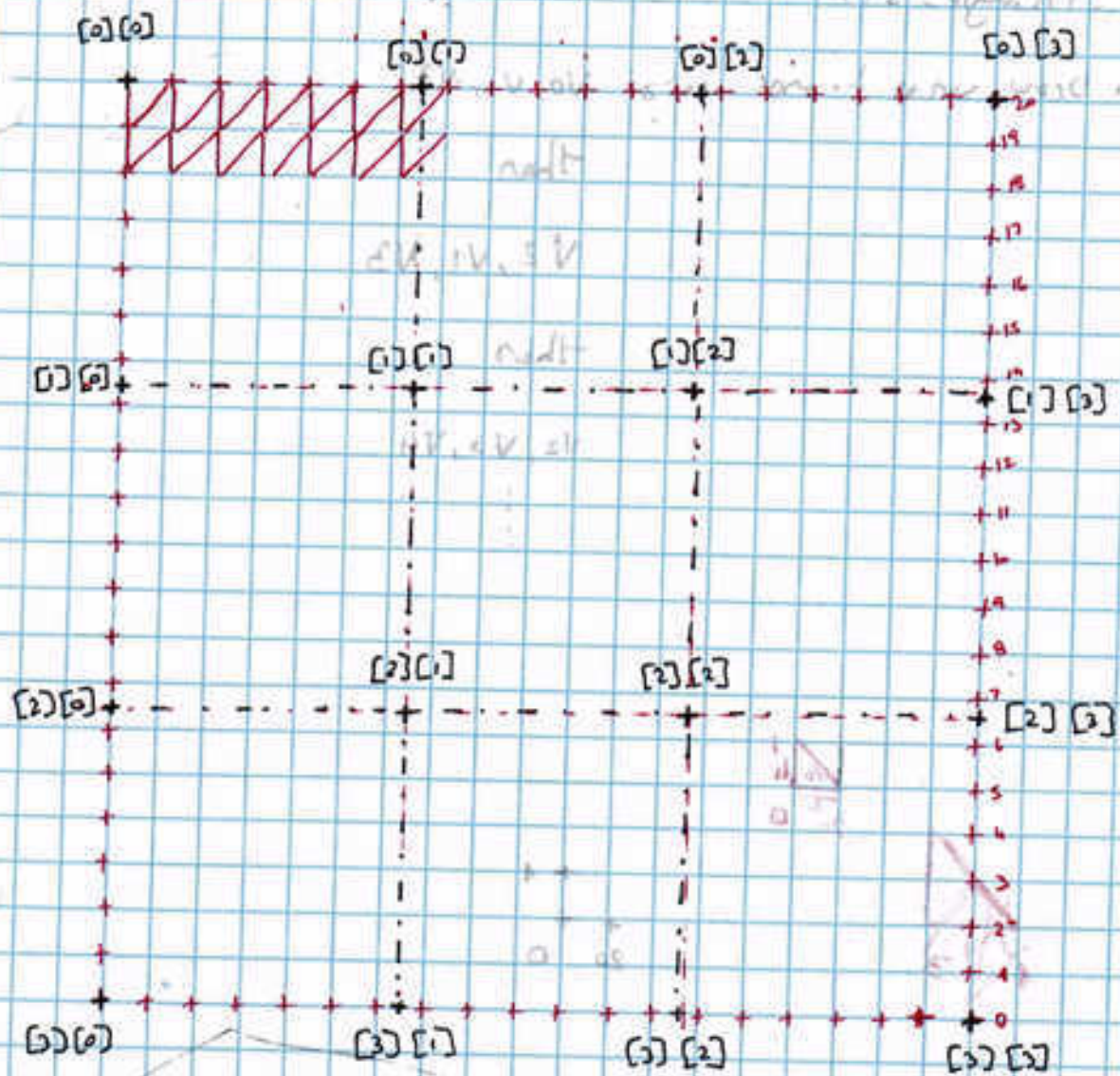


new/old
↓ ↓
[0] [0]



[0] [0]





To draw the next grid triangle
an extra vector is needed

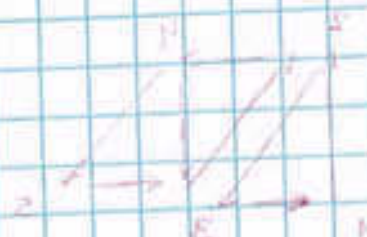
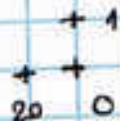
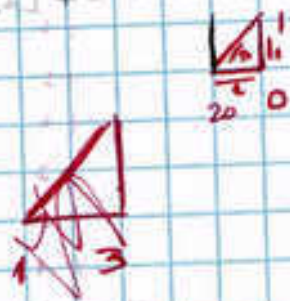
60 GL-Triangle-strip:

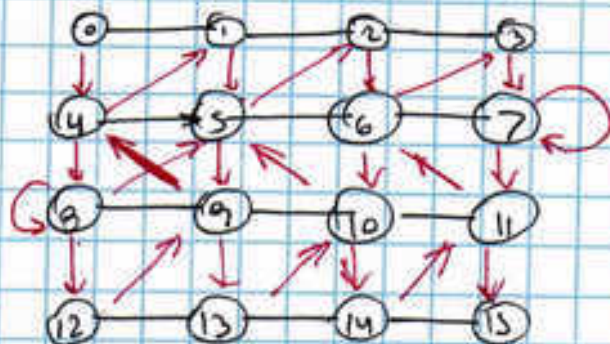
• Draw small trans units V_0, V_1, V_2

Then

$$v_2, v_1, v_3$$

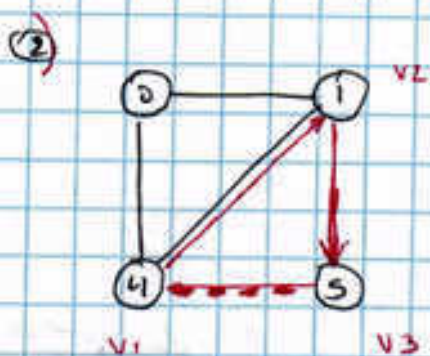
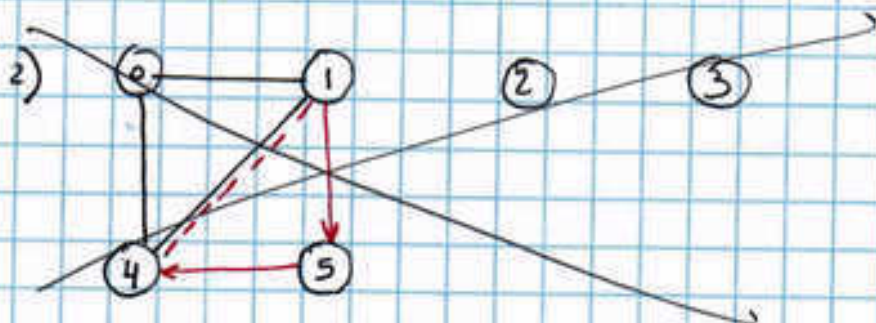
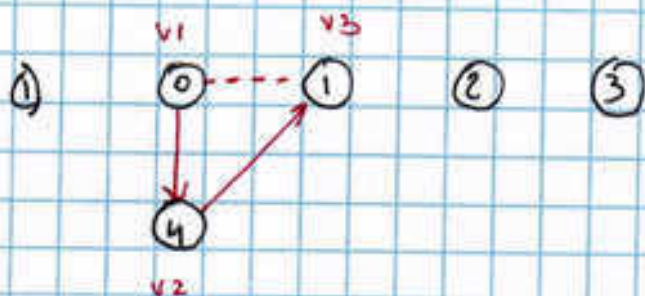
then

$$v_2, v_3, v_4$$


 $i_x \quad i_y \quad i_z$

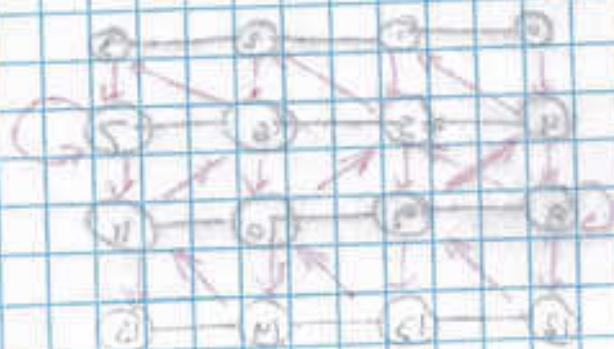
$i = \text{row.x}, j = \text{row.y}, k = \text{row.z}$

6-1000

$$i+1.x, i+1.y, i.y.z$$


تیسرا نمبر

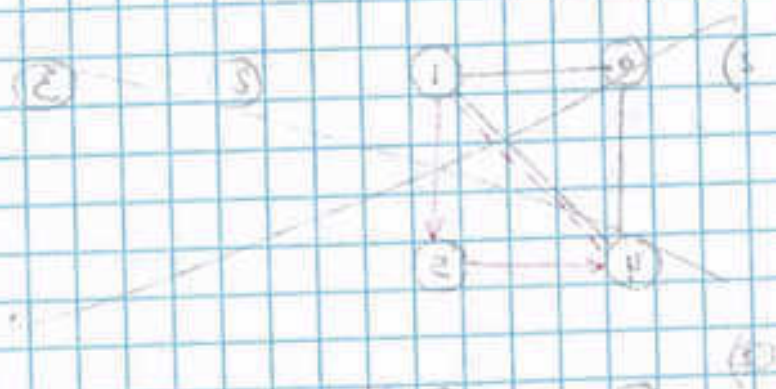
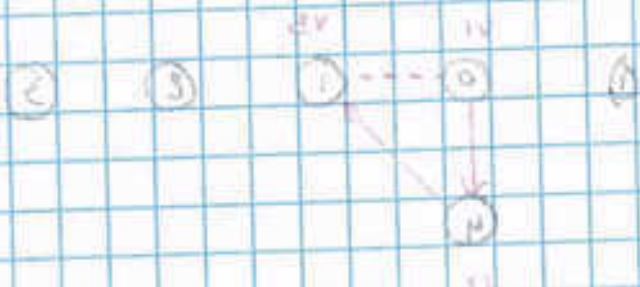
 $l+1$
$$64 \text{ row} + 1$$

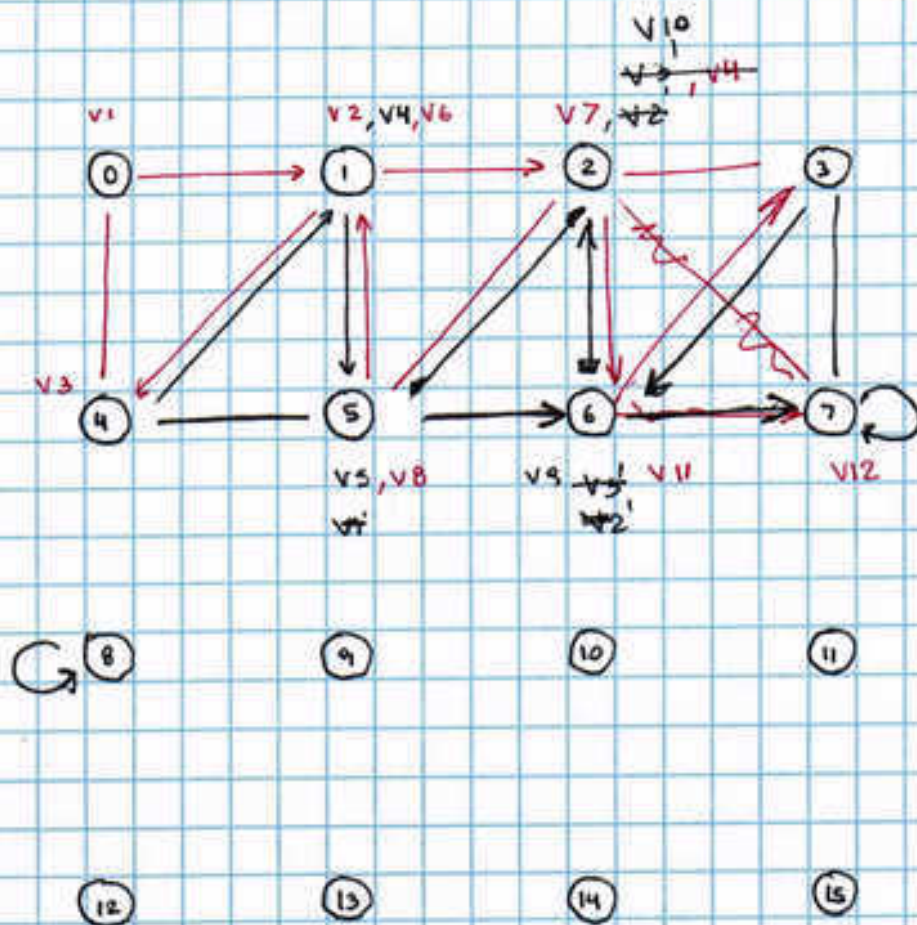


Su g. 1. xi

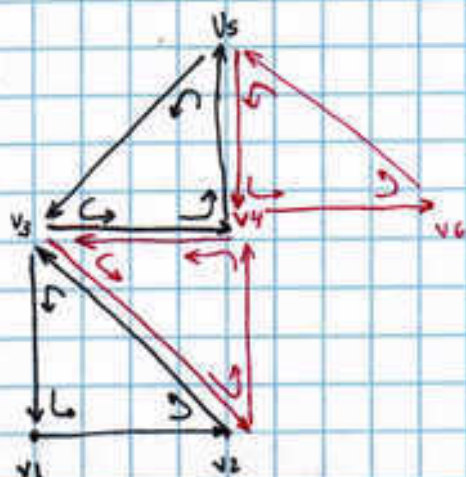
g. 1. xi

Su g. 1. xi





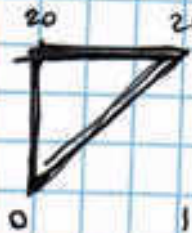
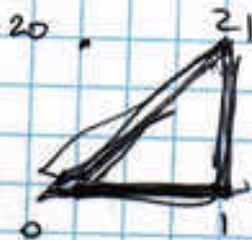
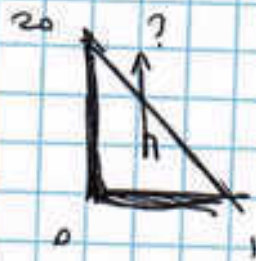
Vertex index: 1 $v_1 \rightarrow v_2 \rightarrow v_3$ odd $n=1$
 : 2 $v_3 \rightarrow v_2 \rightarrow v_4$ even $n=2$
 : 3 $v_3 \rightarrow v_4 \rightarrow v_5$ odd $n=3$
 4 $v_5 \rightarrow v_4 \rightarrow v_6$ even $n=4$



glBegin(GL_TRIANGLE_STRIP

v_1
 v_2
 v_3
 v_4
 v_5
 v_6

glEnd()



① $check = b.spline.getInterval(i-1)$

② if $(i > check)$

$check += b.spline.getInterval$

get vertex

no 1. by vector only
on coordinate & when
sub control point is
used

constructed vector

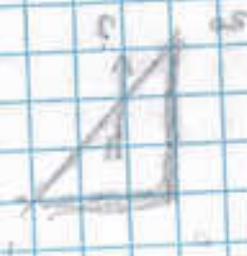
get → was only after vector

• if sub control point is used

• if first & last vector is empty

optimization

2



1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100

(1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100)

1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100

1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100

1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100

1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100

1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100

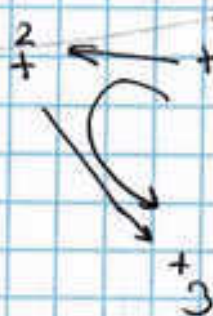
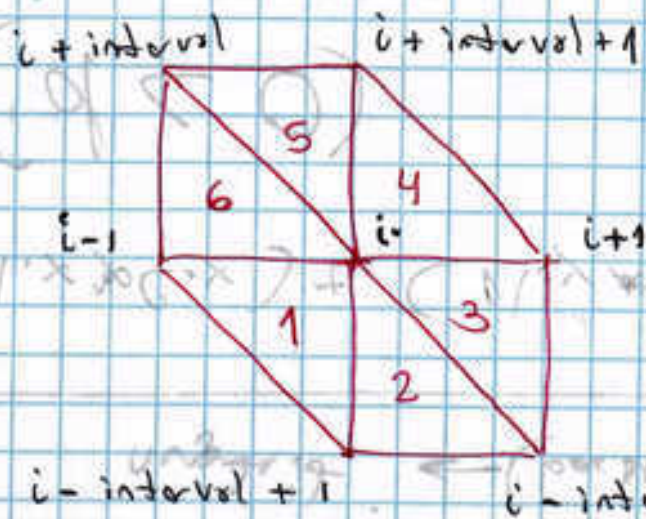
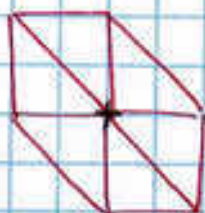
case A



case B



case C





$p = \text{number of } u$

$(0 > p)$

$$(x \cdot z \cdot u) + (x \cdot y \cdot u) + (x \cdot y \cdot x \cdot u) = x$$

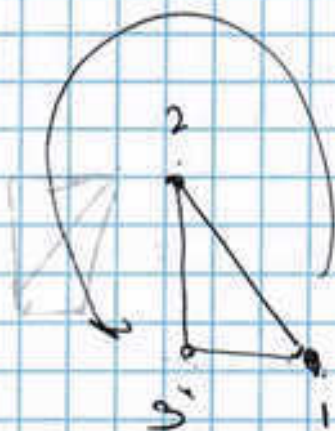
$\int \text{with } \text{len}(x) \cdot \text{len}(y) \cdot \text{len}(z) \rightarrow p \cdot \text{number of } u$

$0 \neq 0$

How do you know the direction of
the normal for these triangles
which dot vertex you use first?

- topic after the test
- light source \rightarrow generate the intensity
 - ↳ How different light sources
need to consider
 - diffuse
 - specular

B-spline



definition of
division

linear interpolation

draw onto

Approximation, a spin
 given points interpretation w/
 different approaches



linear - change no linear

Now the connectivity of a point

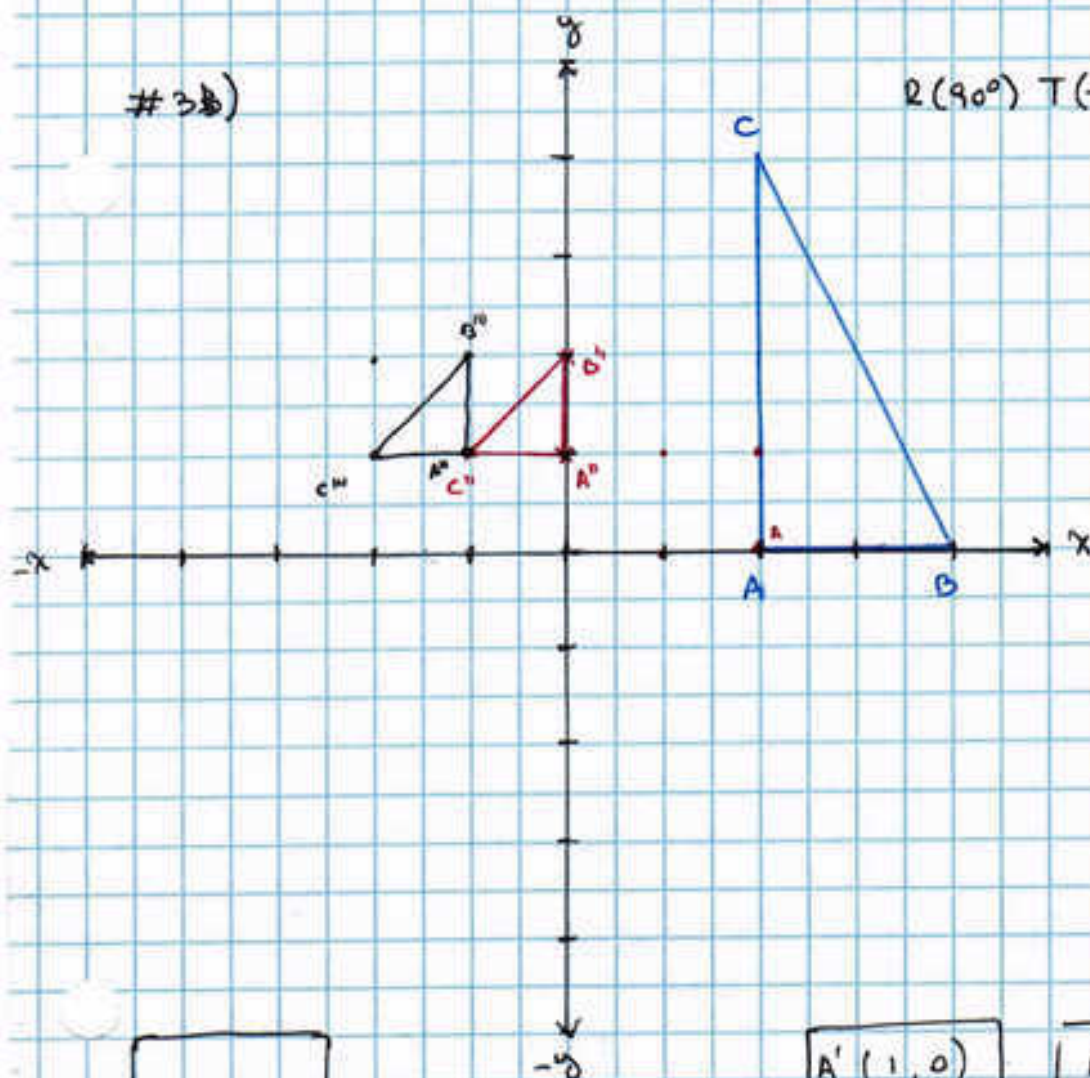
1° 2° 3° order



#3b)

 $R(90^\circ) T(-1,0) S(1/2, 1/4)$

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$$\begin{aligned} A(2,0) \\ B(4,0) \\ C(2,4) \end{aligned}$$

$$S(1/2, 1/4)$$

$$\begin{aligned} A'x &= Ax \cdot Sx = 2 \cdot \frac{1}{2} = 1 \\ B'x &= Bx \cdot Sx = 4 \cdot \frac{1}{2} = 2 \\ C'x &= Cx \cdot Sx = 2 \cdot \frac{1}{2} = 1 \\ A'y &= Ay \cdot Sy = 0 \cdot \frac{1}{4} = 0 \\ B'y &= By \cdot Sy = 0 \cdot \frac{1}{4} = 0 \\ C'y &= Cy \cdot Sy = 4 \cdot \frac{1}{4} = 1 \end{aligned}$$

$$T(-1,0)$$

$$\begin{aligned} A''x &= A'x + (-1) = 0 - 1 = -1 \\ B''x &= B'x + (-1) = 1 - 1 = 0 \\ C''x &= C'x + (-1) = 0 - 1 = -1 \end{aligned}$$

$$\begin{aligned} A'(1,0) \\ B'(2,0) \\ C'(1,1) \end{aligned}$$

$$\begin{aligned} A''(0,1) \\ B''(0,2) \\ C''(-1,1) \end{aligned}$$

$$\begin{aligned} A''(-1,1) \\ B''(-1,2) \\ C''(-2,1) \end{aligned}$$

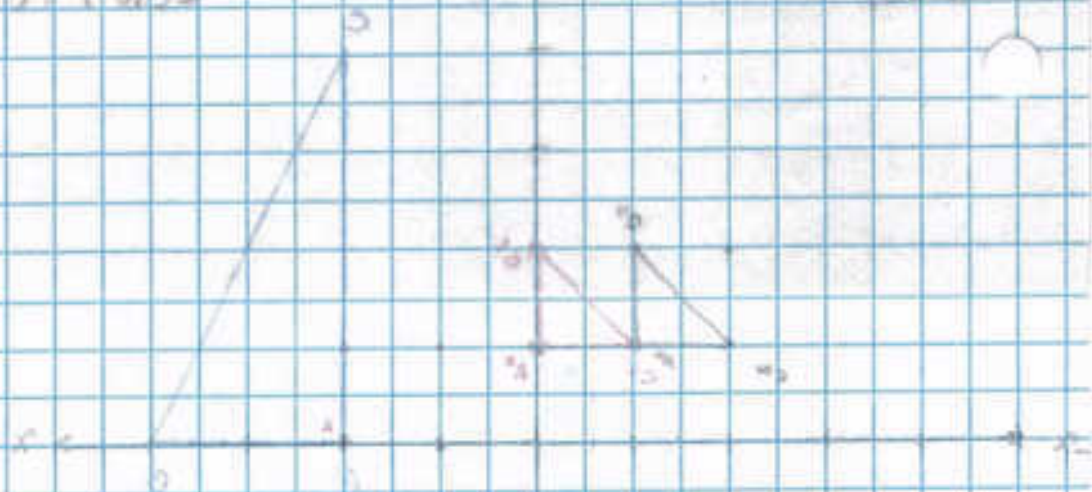
$$R(90^\circ)$$

$$\begin{aligned} A''x &= x \cos \theta - y \sin \theta = 1 \cos(90^\circ) - 0 \sin(90^\circ) = 0 \\ B''x &= x \cos \theta - y \sin \theta = 2 \cos(90^\circ) - 0 \sin(90^\circ) = 0 \\ C''x &= x \cos \theta - y \sin \theta = 1 \cos(90^\circ) - 1 \sin(90^\circ) = -1 \\ A''y &= x \sin \theta + y \cos \theta = 0 \sin(90^\circ) + 1 \cos(90^\circ) = 0 \\ B''y &= x \sin \theta + y \cos \theta = 0 \sin(90^\circ) + 2 \cos(90^\circ) = 0 \\ C''y &= x \sin \theta + y \cos \theta = 1 \sin(90^\circ) + 1 \cos(90^\circ) = 1 \end{aligned}$$

$$\begin{aligned} A''y &= A'y + 0 = 1 + 0 = 1 \\ B''y &= B'y + 0 = 0 + 0 = 0 \\ C''y &= C'y + 0 = 1 + 0 = 1 \end{aligned}$$

$$(A', A')^T = (0, 1)^T \quad (P, P) \Delta$$

(a) 30



$$\begin{array}{|l|} \hline \begin{array}{l} (1, 0)^T A \\ (2, 0)^T A \\ (1, 1)^T A \end{array} \\ \hline \end{array} \quad \begin{array}{|l|} \hline \begin{array}{l} (0, 1)^T A \\ (0, 2)^T A \\ (1, 1)^T A \end{array} \\ \hline \end{array}$$

(P, P) Δ

$$\begin{array}{|l|} \hline \begin{array}{l} (0, 2)^T A \\ (0, 1)^T A \\ (1, 2)^T A \end{array} \\ \hline \end{array}$$

(A', A') Δ

$$\begin{aligned} 1 &= (0, 1)^T A = (0, 1)^T \begin{pmatrix} 1 \\ 0 \end{pmatrix} = 0 \cdot 1 + 1 \cdot 0 = 0 \\ 2 &= (0, 2)^T A = (0, 2)^T \begin{pmatrix} 1 \\ 0 \end{pmatrix} = 0 \cdot 1 + 2 \cdot 0 = 0 \\ 1 &= (1, 1)^T A = (1, 1)^T \begin{pmatrix} 1 \\ 0 \end{pmatrix} = 1 \cdot 1 + 1 \cdot 0 = 1 \\ 2 &= (0, 2)^T A + (1, 1)^T A = (0, 2)^T \begin{pmatrix} 1 \\ 0 \end{pmatrix} + (1, 1)^T \begin{pmatrix} 1 \\ 0 \end{pmatrix} = 0 + 1 = 1 \\ 3 &= (0, 2)^T A + (0, 1)^T A = (0, 2)^T \begin{pmatrix} 1 \\ 0 \end{pmatrix} + (0, 1)^T \begin{pmatrix} 1 \\ 0 \end{pmatrix} = 0 + 0 = 0 \\ 1 &= (0, 2)^T A + (0, 1)^T A + (1, 1)^T A = (0, 2)^T \begin{pmatrix} 1 \\ 0 \end{pmatrix} + (0, 1)^T \begin{pmatrix} 1 \\ 0 \end{pmatrix} + (1, 1)^T \begin{pmatrix} 1 \\ 0 \end{pmatrix} = 0 + 0 + 1 = 1 \end{aligned}$$

$$\begin{aligned} 1 &= A' \cdot 2 = 0 \cdot 2 + 1 \cdot 0 = 0 \\ 2 &= A' \cdot 1 = 0 \cdot 1 + 1 \cdot 0 = 0 \\ 1 &= A' \cdot 3 = 0 \cdot 3 + 1 \cdot 0 = 0 \\ 0 &= A' \cdot 0 = 0 \cdot 0 + 1 \cdot 0 = 0 \\ 0 &= A' \cdot 0 = 0 \cdot 0 + 1 \cdot 0 = 0 \\ 1 &= A' \cdot 1 = 0 \cdot 1 + 1 \cdot 0 = 0 \end{aligned}$$

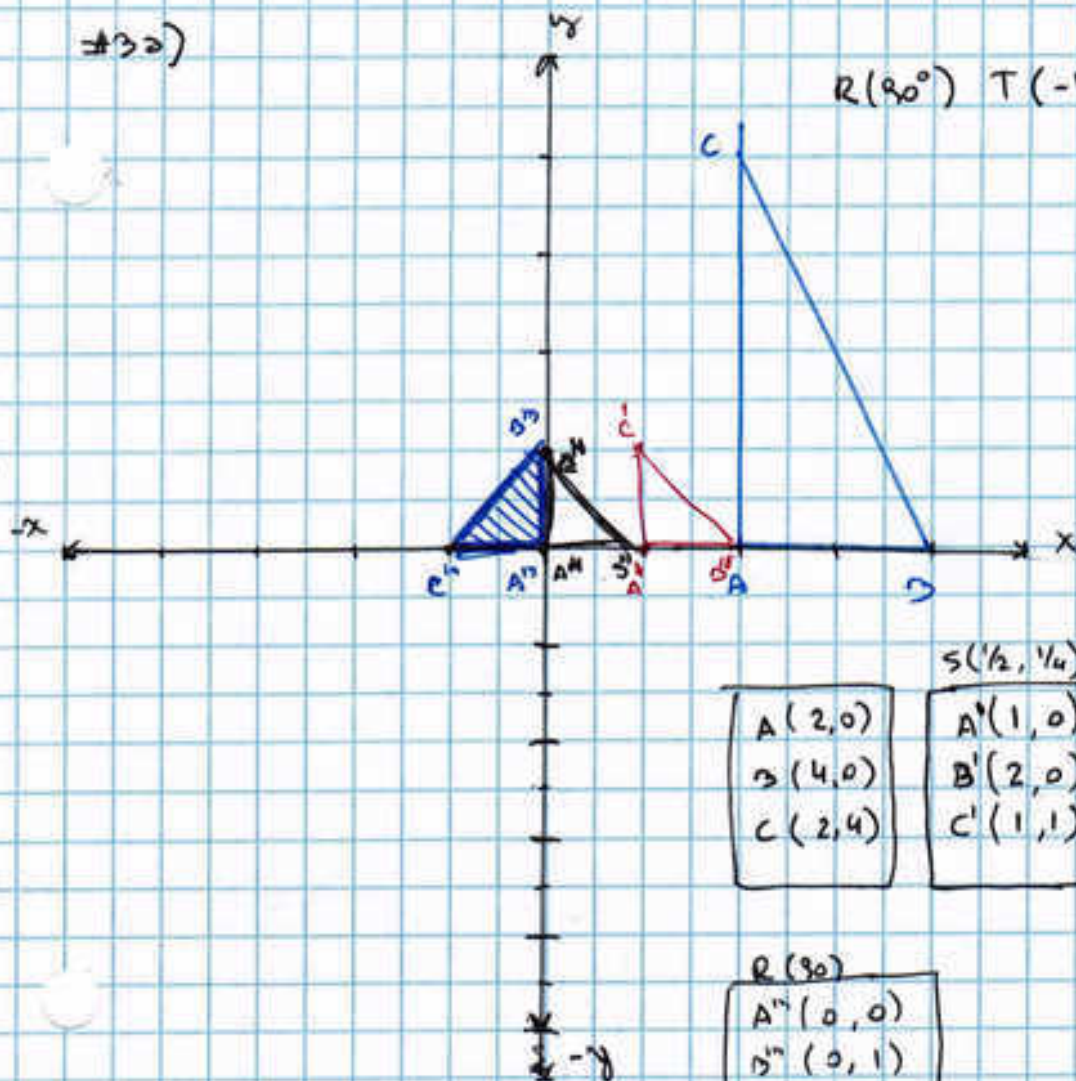
$$\begin{aligned} 1 &= 0 \cdot 1 + 0 + 1 \cdot A = A \\ 2 &= 0 \cdot 1 + 0 + 1 \cdot A = A \\ 1 &= 0 \cdot 1 + 0 + 1 \cdot A = A \end{aligned}$$

$$\begin{aligned} 1 &= 1 - 0 \cdot (1-1) + 1 \cdot A = A \\ 2 &= 1 - 0 \cdot (1-1) + 1 \cdot A = A \\ 3 &= 1 - 1 \cdot (1-1) + 1 \cdot A = A \end{aligned}$$

32)

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$R(90^\circ)$ $T(-1,0)$ $S(1/2, 1/4)$



	$S(1/2, 1/4)$	$T(-1, 0)$
$A(2, 0)$	$A'(1, 0)$	$A''(0, 0)$
$B(4, 0)$	$B'(2, 0)$	$B''(1, 0)$
$C(2, 4)$	$C'(1, 1)$	$C''(0, 1)$

$R(90^\circ)$
$A'''(0, 0)$
$B'''(0, 1)$
$C'''(-1, 0)$

$$A_x''' = A_x'' \cos(90^\circ) - A_y'' \sin(90^\circ) = 0 \cdot \cancel{\cos 90^\circ} - 0 \cdot \cancel{\sin 90^\circ} = 0$$

$$B_x''' = B_x'' \cos(90^\circ) - B_y'' \sin(90^\circ) = 1 \cdot \cancel{\cos 90^\circ} - 0 \cdot \cancel{\sin 90^\circ} = 0$$

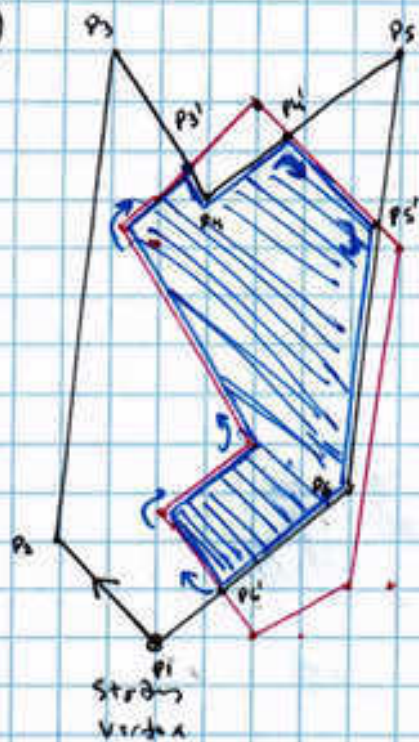
$$C_x''' = C_x'' \cos(90^\circ) - C_y'' \sin(90^\circ) = 0 \cdot \cancel{\cos 90^\circ} - 1 \cdot \cancel{\sin 90^\circ} = -1$$

$$A_y''' = A_x'' \sin(90^\circ) + A_y'' \cos(90^\circ) = 0 \cdot \cancel{\sin 90^\circ} + 0 \cdot \cancel{\cos 90^\circ} = 0$$

$$B_y''' = B_x'' \sin(90^\circ) + B_y'' \cos(90^\circ) = 1 \cdot \cancel{\sin 90^\circ} + 0 \cdot \cancel{\cos 90^\circ} = 1$$

$$C_y''' = C_x'' \sin(90^\circ) + C_y'' \cos(90^\circ) = 0 \cdot \cancel{\sin 90^\circ} + 1 \cdot \cancel{\cos 90^\circ} = 0$$

#17.)



#18.)

