COMP220: Graphics & Simulation

4: Meshes and movement

Agenda

- Portfolio task check-in (sprint planning)
- Complex meshes (goodbye triangle, hello cube!)
- First-person camera control

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- ▶ Your first sprint review is **in 2 weeks**

More complex meshes
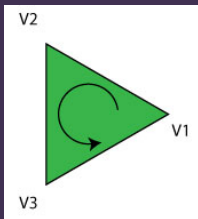
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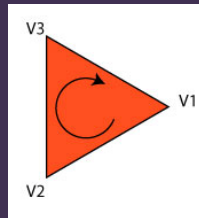
▶ OpenGL determines this by **winding order**
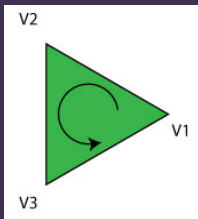
If the vertices go **anticlockwise**, you are looking at the **front**

If the vertices go **clockwise**, you are looking at the **back**

Backface culling

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- ▶ Triangles whose front face is not visible will be **culled**
- ▶ Culled faces are not passed through the rasteriser or fragment shader
- ▶ Saves time, and should make no difference to appearance — as long as all meshes are closed and have correct winding

When backface culling goes bad?

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```
GLfloat vertexPositions[] = {
    -0.5f, -0.5f, 0.0f,
    0.5f, -0.5f, 0.0f,
    0.0f,  0.5f, 0.0f,
};

glBufferData(GL_ARRAY_BUFFER,
    sizeof(vertexPositions), // the size
    vertexPositions,         // the pointer
    GL_STATIC_DRAW);
```

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▶ The third argument to `glBufferData` is a **void***, which can accept any pointer type

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- `data()` returns a pointer to the data inside a
  `std::vector`
- `size()` returns the number of elements, so multiplying
  by `sizeof`(glm::vec3) gives the size in bytes

Let's draw a square!
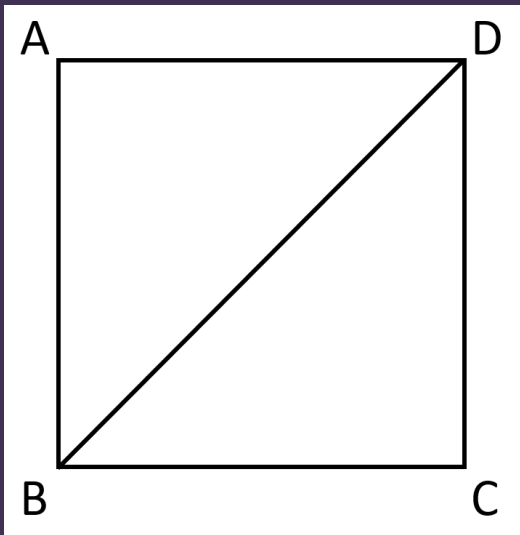
Let's draw a cube!
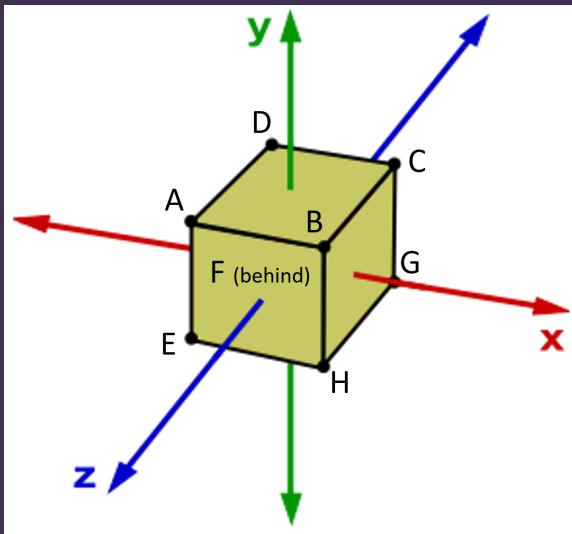
First person camera control

The plan

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- Represent the player's **position** by a 3D vector

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- Represent the player's **position** by a 3D vector
- Represent the player's **orientation** by Euler angles
- Mouse events change these angles
- View matrix is calculated using position and orientation
- To move forwards, use the Euler angles to find the "forward" vector, and offset the position by this vector

Keyboard and mouse in SDL

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Use **relative mouse mode**

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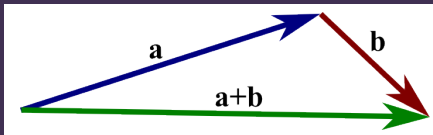- ▶ Otherwise, the player will move jerkily according to the key repeat rate

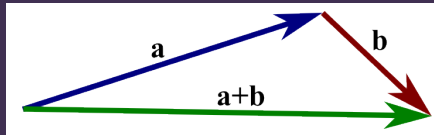# Vector addition

Vector addition
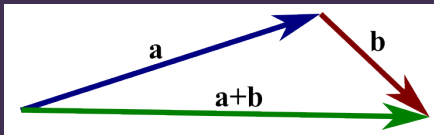
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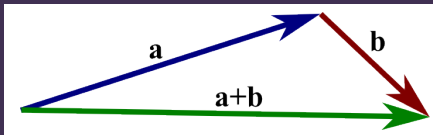
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- E.g. if *a* is current position, and
- *b* is the distance and direction we want to move, then
- $a + b$ is the new position

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- So multiplying a unit vector by b gives a vector of length b, parallel to the unit vector
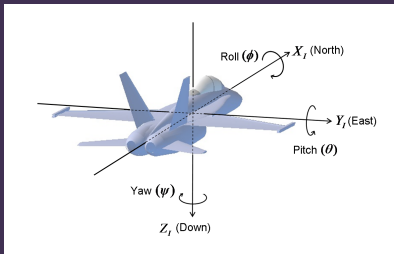
Representing look direction
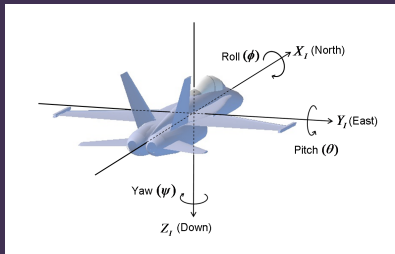
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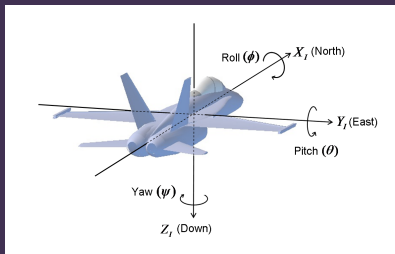
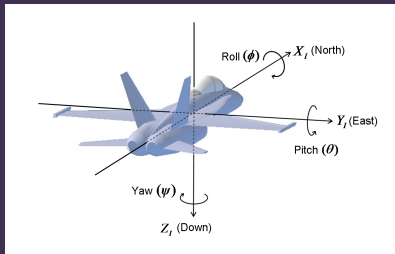# Representing look direction

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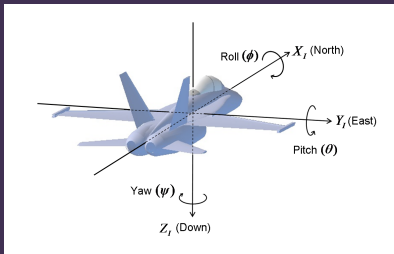- ▶ Don't need roll, just pitch and yaw

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- Don't need roll, just pitch and yaw
- (Not using roll eliminates the gimbal lock problem)
- Forward vector and look vector can be obtained by appropriate rotation of a unit vector