BENDING PAPER ANIMATION

A CASE STUDY

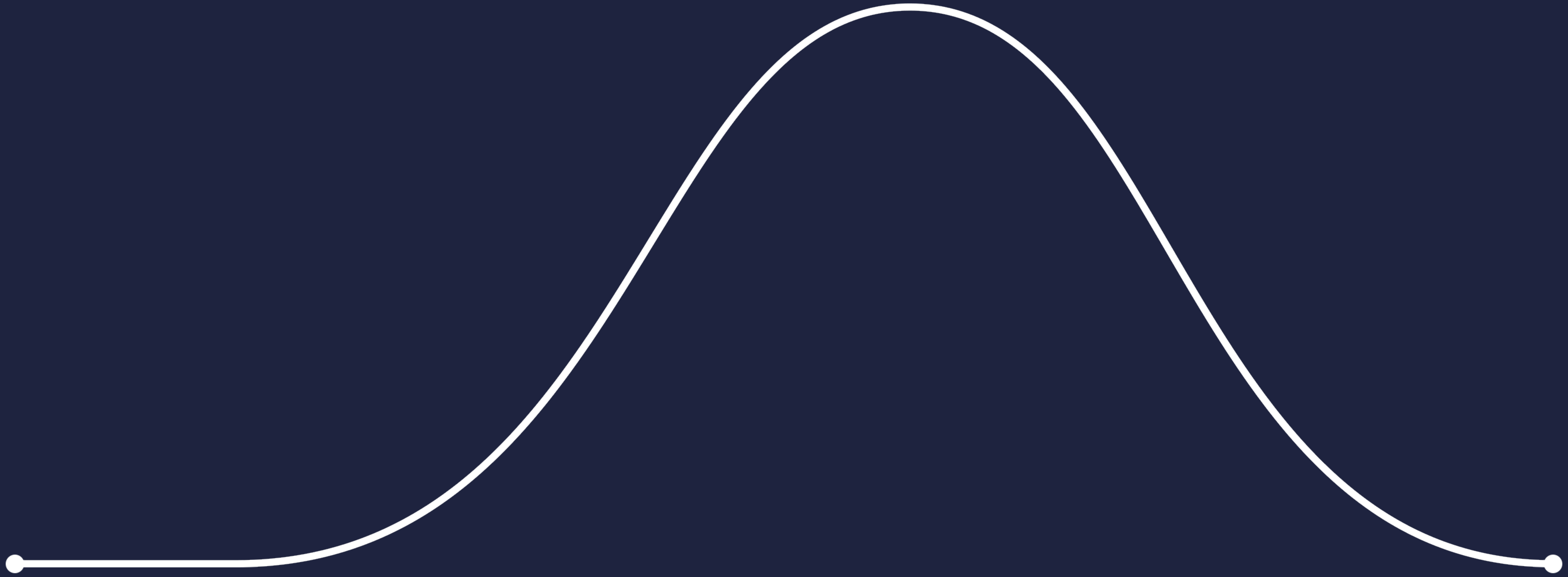
DEMO

VIEW SNAPSHOTS

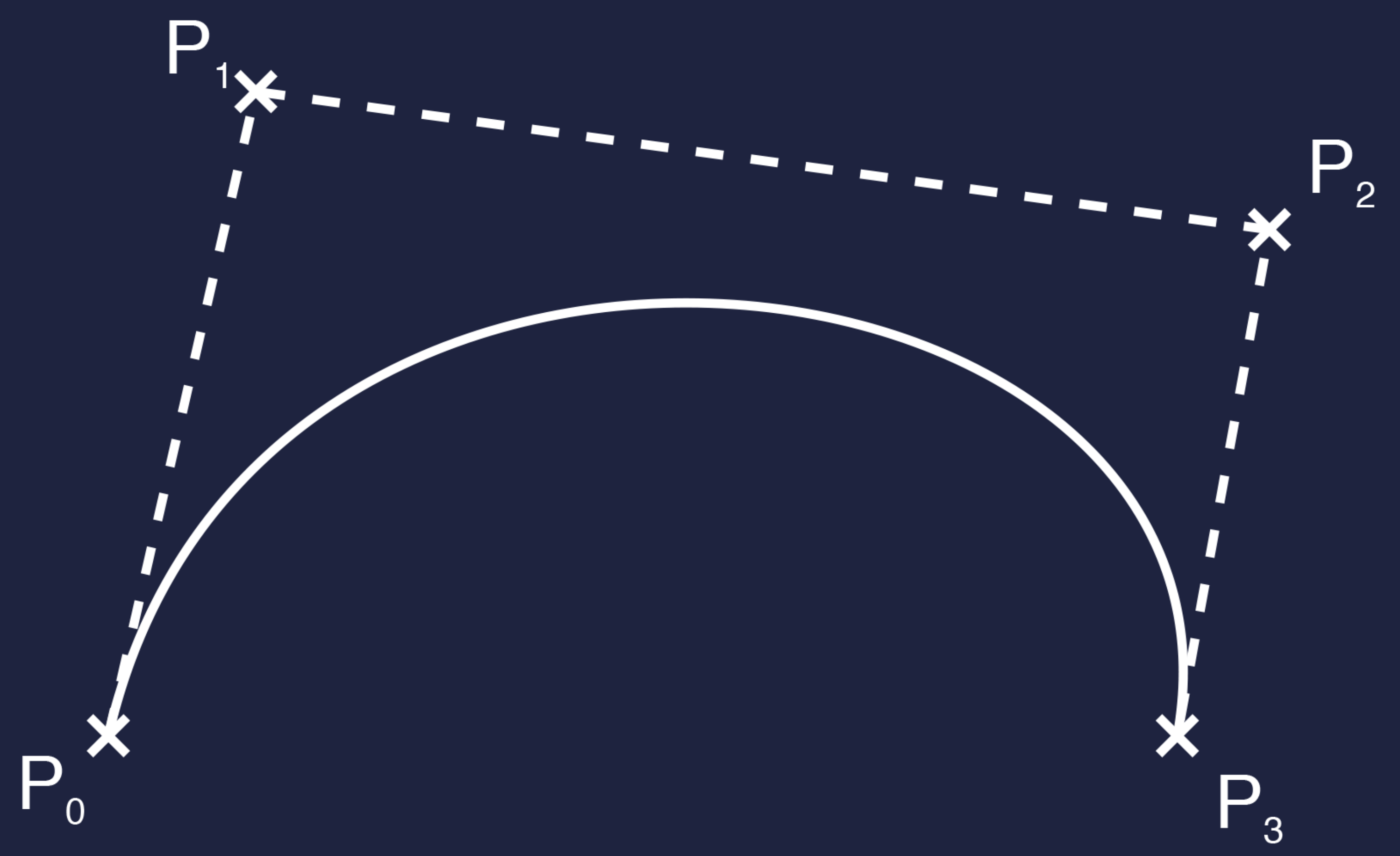
```
- (UIImage *)shp_snapshotImageAfterScreenUpdates:(BOOL)afterUpdate {
    CGSize size = self.bounds.size;
    // prevent creating a context with empty size,
    // would result in a crash with "CGContextSaveGState: invalid context 0x0."
    if (CGSizeEqualToSize(size, CGSizeZero)) return nil;

    // scale == 0: use main screen's device scale
    UIGraphicsBeginImageContextWithOptions(size, YES, 0);
    [self drawViewHierarchyInRect:self.bounds afterScreenUpdates:afterUpdate];
    UIImage *image = UIGraphicsGetImageFromCurrentImageContext();
    UIGraphicsEndImageContext();

    return image;
}
```

OPENGL ES 2.0

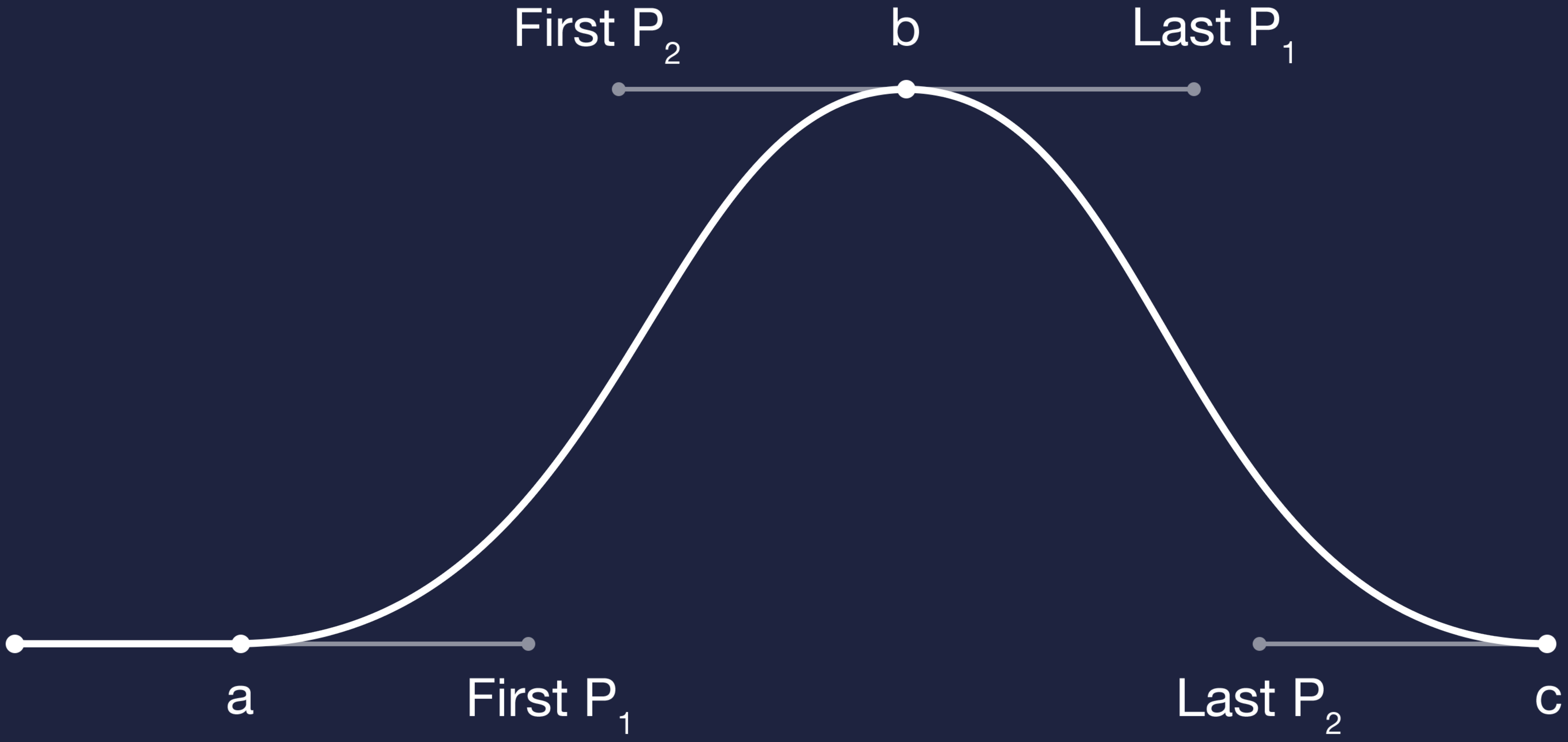
MESH



CUBIC BÉZIER CURVES



$$\mathbf{B}(t) = (1-t)^3\mathbf{P}_0 + 3(1-t)^2 t\mathbf{P}_1 + 3(1-t)t^2\mathbf{P}_2 + t^3\mathbf{P}_3 \; , t \in [0,1]$$


First P_2
b
Last P_1
a
First P_1
Last P_2
c

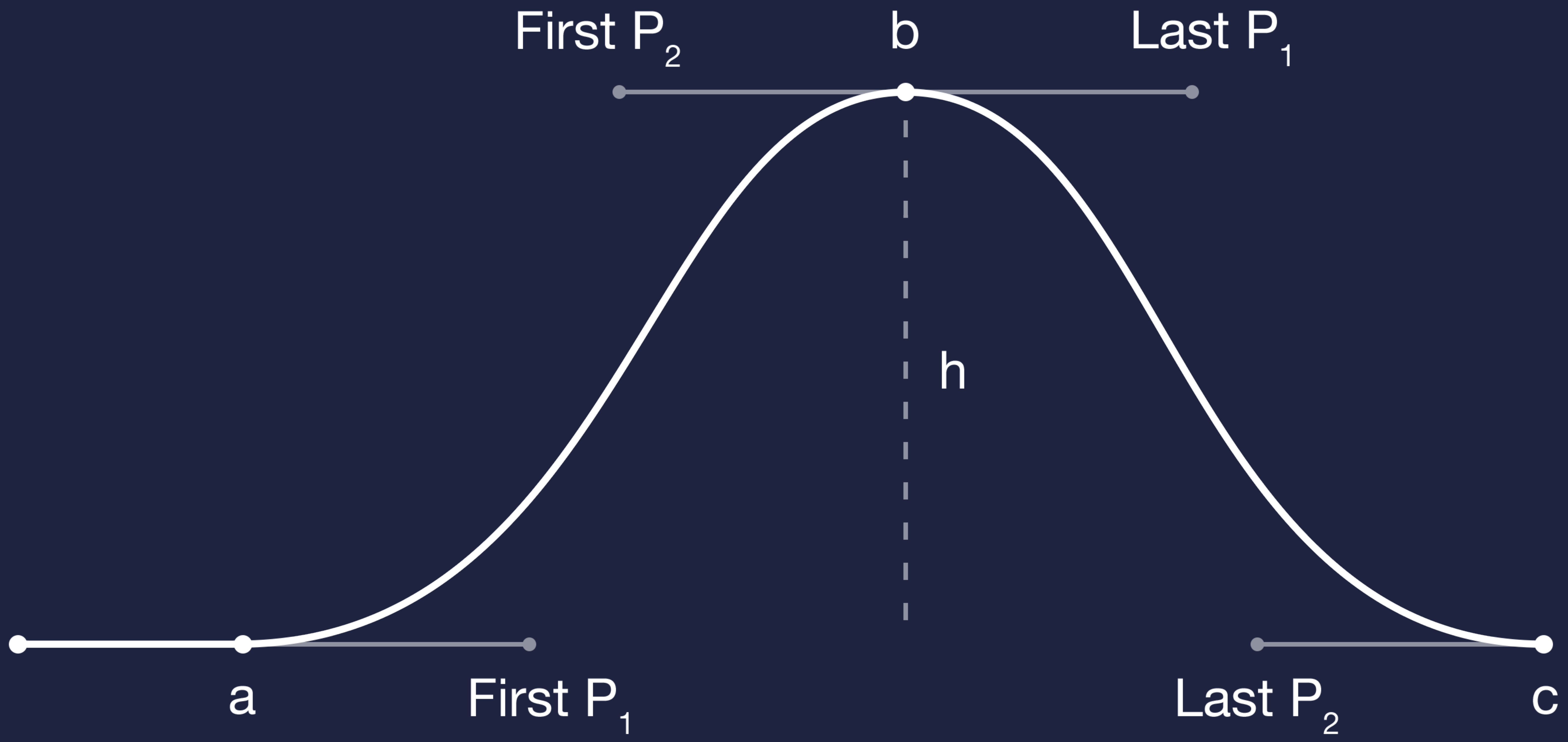
DEMO

PAPER IS NOT ELASTIC

=

CONSTANT CURVE LENGTH

ESTIMATE CURVE LENGTH NUMERICALLY BY STEPPING STROUGH t AND SUM DISTANCE BETWEEN POINTS


First P_2
b
Last P_1
h
a
First P_1
Last P_2
c

HOW DO WE CALCULATE THE HEIGHT?

SINCE OUR CURVES ARE MONOTONIC WE CAN ESTIMATE HEIGHT ITERATIVELY:

$$bx \cdot k = height + e$$

for some constant k.

$$k_{next} = k - e * \delta$$

where δ is a small positive number

SOLVING NUMERICALLY BY ITERATION IS TOO SLOW @ 60 FPS

TRICK

bx CHANGES SLOWLY COMPARED TO THE FRAMERATE

SO WE CAN DO ONE ITERATION PER FRAME AND THE ERROR WILL CONVERGE TOWARDS 0

SHAPE

WE ARE HIRING!

SEND EMAIL TO OLE@SHAPE.DK