# Line

## General Formulas about the Lines

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A (x1, y1)  B (x2, y2) | o (x, y)  =  = | | hypotenuse  = | C (x3, y3)  D (x4, y4) |
| = | |  | | |
| = | |  | | |
| = | |  | | |
| = | |  | | |
| = | |  | | |
| = | |  | | |
| = | |  | | |
| = | |  | | |

## Get All Points on Pixel Screen

### Examples

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| Example1  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  | A (x1, y1) |  |  | |  |  |  |  |  | | Example2  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  | A (x1, y1) |  |  | |  |  |  |  |  | | Example3   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  | B (x2, y2) | |  |  |  |  |  | |  |  |  |  |  | |  |  |  | A (x1, y1) |  | |  |  |  |  |  | |

### Algorithm

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## Rotate Around Point

### Examples

p (x, y)

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| Example1  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  | new (x2, y2) |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  | new (x1, y1) |  | |  |  |  | p (x, y)  A (x1, y1) |  | | Example2   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  | A (x1, y1) |  | |  |  |  |  | p (x, y) | | new (x1, y1) |  |  |  |  | |  |  |  |  | new (x2, y2) | |  |  |  |  | B (x2, y2) | | Example3  A (x1, y1)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | |  | new (x1, y1) |  |  |  | |  |  | B (x2, y2) |  |  | |  | new (x2, y2) |  |  |  | |  |  |  |  |  | |

### Algorithm

Angle =

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## Are Lines Parallel?

### Examples

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| Example1  D (x4, y4)  C (x3, y3)  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  | A (x1, y1) |  |  | |  |  |  |  |  | | Example2  D (x4, y4)  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | |  |  |  |  |  | | A (x1, y1) |  |  |  |  | |  |  |  |  |  | |  | C (x3, y3) |  |  |  | | Example3  D (x4, y4)  C (x3, y3)  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | |  | A (x1, y1) |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

### Algorithm

## Are Lines Intersect as Segment?

### Examples

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| Example1  B (x2, y2)  C (x3, y3)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | D (x4, y4) |  |  |  | |  |  |  |  |  | |  |  |  | p (x, y) |  | |  |  | A (x1, y1) |  |  | |  |  |  |  |  | | Example2  D (x4, y4)  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | |  |  |  |  |  | | A (x1, y1) |  |  | p (x, y) |  | |  |  |  |  |  | |  | C (x3, y3) |  |  |  | | Example3  p (x, y)  A (x1, y1)  D (x4, y4)  C (x3, y3)  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

### Algorithm

## Are Point and Line Intersect?

### Examples

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Example1  p (x, y)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | |  |  |  |  | B (x2, y2) | |  |  |  |  |  | |  |  | A (x1, y1) |  |  | |  |  |  |  |  | | Example2  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | |  |  |  |  |  | | A (x1, y1) |  |  | p (x, y) |  | |  |  |  |  |  | |  |  |  |  |  | | Example3  p (x, y)  A (x1, y1)  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

### Algorithm

## Are Point and Line as Segment Intersect?

### Examples

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Example1  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  | p (x, y) | |  |  |  |  |  | |  |  |  |  |  | |  |  | A (x1, y1) |  |  | |  |  |  |  |  | | Example2  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | |  |  |  |  |  | | A (x1, y1) |  |  | p (x, y) |  | |  |  |  |  |  | |  |  |  |  |  | | Example3  p (x, y)  A (x1, y1)  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

### Algorithm

## Distance of Between Point and Line

### Examples

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Example1  distance  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  | p (x, y) |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  | A (x1, y1) |  |  | |  |  |  |  |  | | Example2  p (x, y)  A (x1, y1)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  | distance |  |  | |  |  |  |  |  | |  |  |  | B (x2, y2) |  | |  |  |  |  |  | |  |  |  |  |  | | Example3  A (x1, y1)  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | |  |  | p (x, y) |  |  | |  |  |  | distance |  | |  |  |  |  |  | |  |  |  |  |  | |

### Algorithm

## Distance of Between Point and Line as Segment

### Examples

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| Example1  distance  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  | p (x, y) |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  | A (x1, y1) |  |  | |  |  |  |  |  | | Example2  B (x2, y2)  p (x, y)  A (x1, y1)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  | distance |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | | Example3  p (x, y)  A (x1, y1)  B (x2, y2)   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  | distance |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

### Algorithm