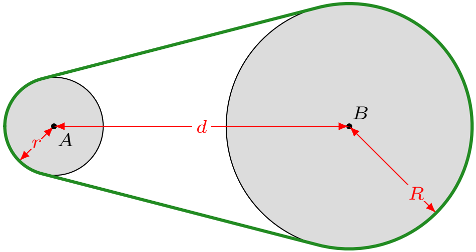
Nerdstuff

Source code at: https://github.com/dmorgorg/LaTeX/blob/master/misc/misc.pdf

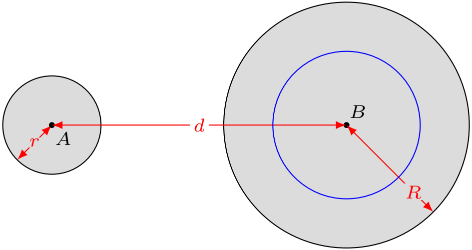
Last updated on April 17, 2020



Two pulleys, centred at A and B, have radii r and R. The distance from A to B is d.

Determine the length of the belt required to go round both pulleys.

Geometry :: Belt-Length



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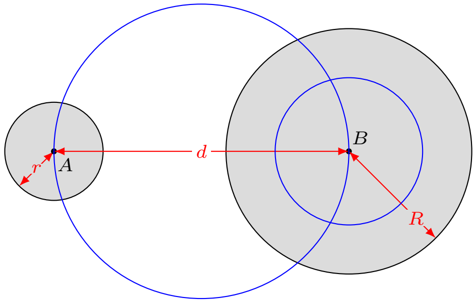

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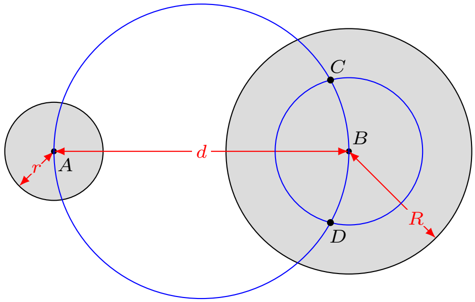

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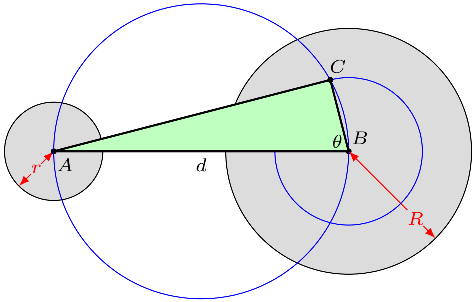

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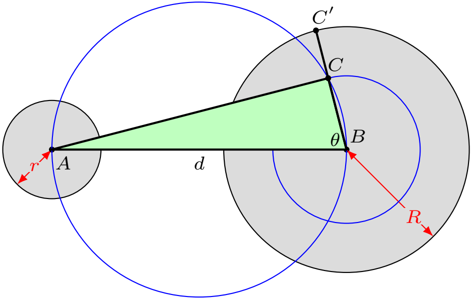
4. Consider $\triangle ABC$: $\angle ACB = 90^\circ$ since it is an angle inscribed in a semicircle. Then:

$$AC = \sqrt{d^2 - (R-r)^2}$$

$$\theta = \sin^{-1}\left(\frac{\sqrt{d^2 - (R-r)^2}}{d}\right)$$



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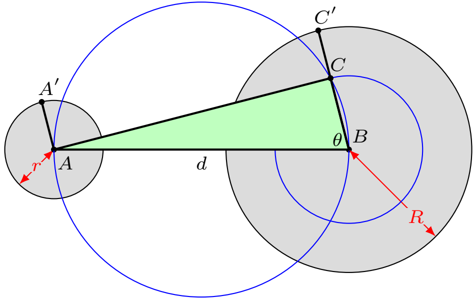

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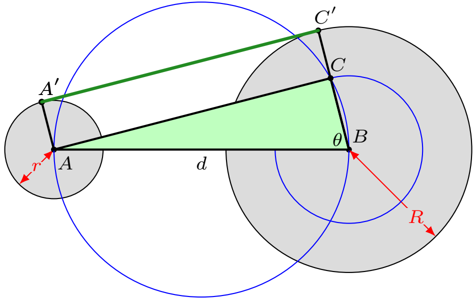

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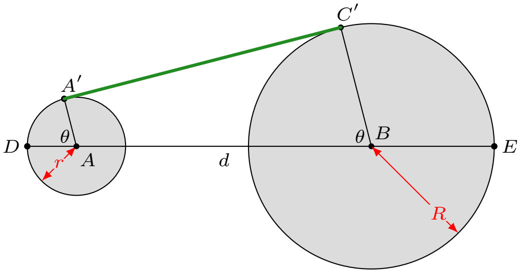

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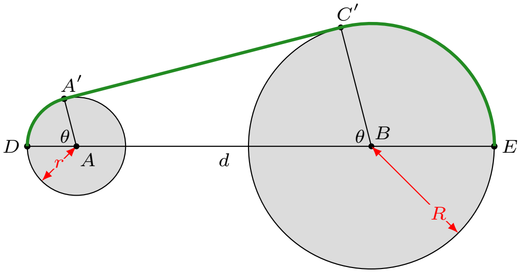

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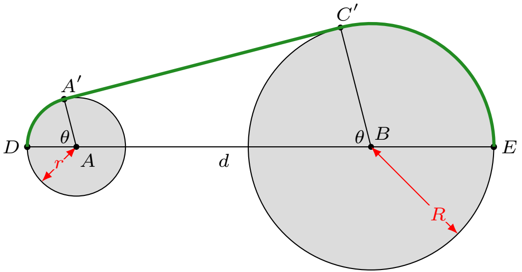
9 The angles (θ and $\pi - \theta$) that these arcs subtend at the pulley centres, with the radius of each pulley, are used to determine the arc-lengths (θ in radians):

$$DA' = r\theta \text{ and } C'D = R(\pi - \theta)$$



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10 Belt-length:

$$= 2\left(DA' + A'C' + C'E\right)$$
$$= 2\left(r\theta + \sqrt{d^2 - (R-r)^2} + R(\pi - \theta)\right)$$

where

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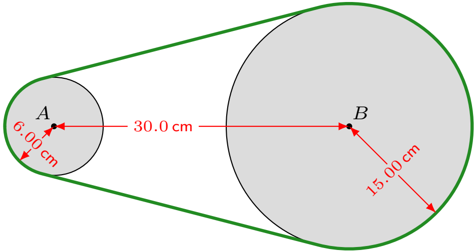

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Example:

$$\theta = \sin^{-1}\left(\frac{\sqrt{d^2-(R-r)^2}}{d}\right) = \sin^{-1}\left(\frac{\sqrt{6.00^2-1.50^2}}{6.00}\right) = 1.3181 \text{ (radians)}$$

$$\text{B-L} = 2\left(6.00 \times 1.3181 + \sqrt{6.00^2-1.50^2} + 15.00 \times (\pi - 1.3181)\right) = 82.141$$

The belt length is 82.1 cm.

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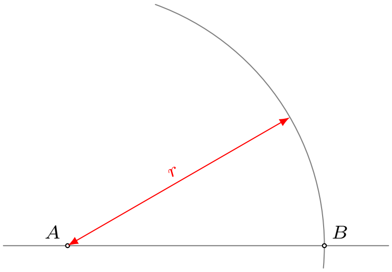
Geometry :: How To Construct A 30° Angle With A Pair Of Compasses



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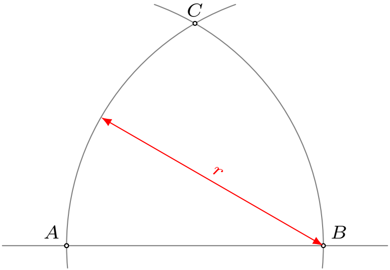

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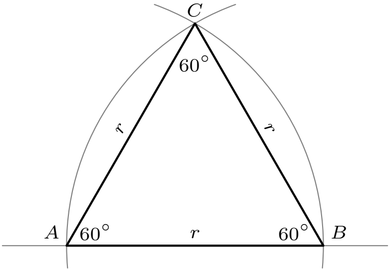

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5. $\triangle ABC$ is equilateral with sides of length r.

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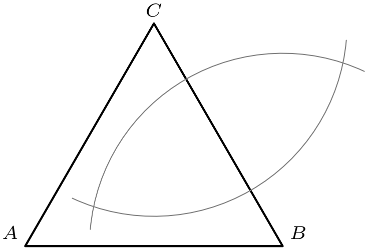

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6. Draw arcs centred at B and C, with radius $r' \approx 0.75r$, as shown.

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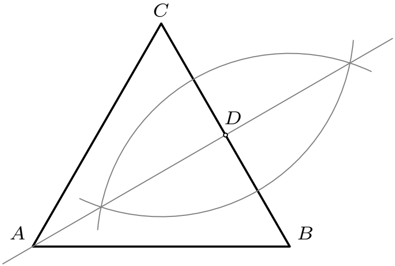

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7. Draw a line between the intersection of these two arcs. This line bisects BC at D. It also passes through A, bisecting $\angle BAC$.

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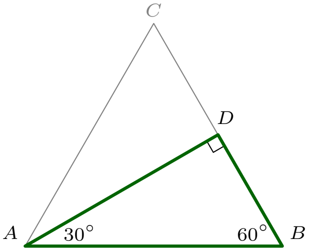

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8. $\angle BAD = 30^\circ$, as required.

Web :: Dynamic font sizes with CSS

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  `font-size:calc(9px + 1vw);` sets font size at 13px for phone width of 400px and font size of 21px for window size of 1200px.

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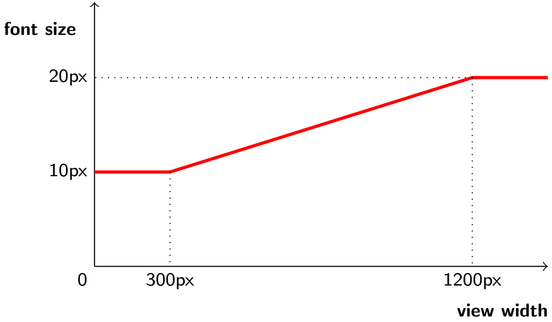
  Still not exactly what you want? Maybe `font-size:calc(4px + 1.5vw);`?
- For more precise control, without trial and error that rapidly becomes frustrating, I turned to this excellent CSS-tricks page showing examples such as

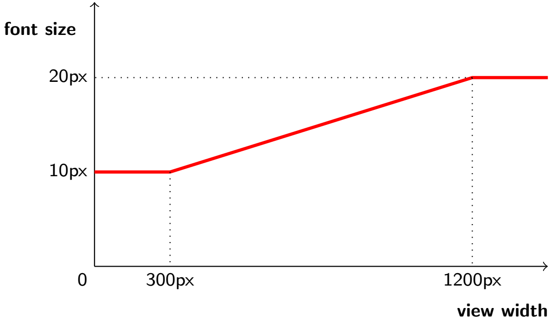
  ```
  font-size:  calc(16px + 6 * ((100vw - 320px) / 680));
  ```

  What are these magic numbers? At the moment, I can tell that, at a screen width of 320px, the font size is 16px. Font size increases smoothly until, at a screen width of 1000px, the font size of 22px. But I probably won't remember how to figure that out next week! The CSS-tricks page doesn't show how these numbers are derived...

  ...but it's just some (relatively) simple high-school math. All you need to recall from high-school is the equation of a line in the form: $\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$



1. We can graph our desired font size against view width as shown. In this case: view widths less than 300px have a font size of 10px; font sizes grow uniformly from 10px at 300px view width to a font-size 20px at 1200px window width; and, for window sizes over 1200px, the font size remains 20px. How do we achieve this with CSS?



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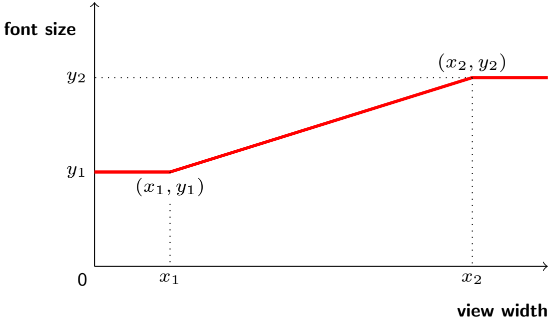

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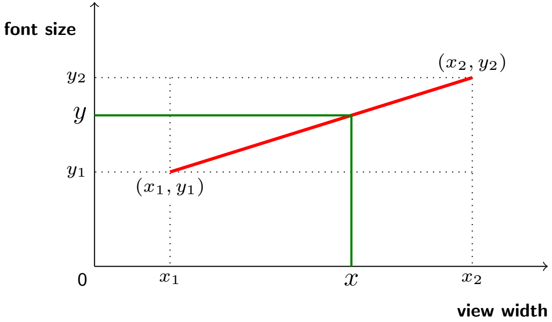
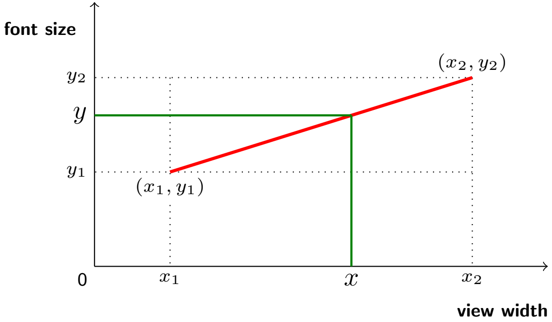
3. Instead of using the fixed numbers, we'll generalise and use variables so we can easily adjust our formula for different required values.



4 For now, just focus on the sloped line as a function from view width x to font size y.



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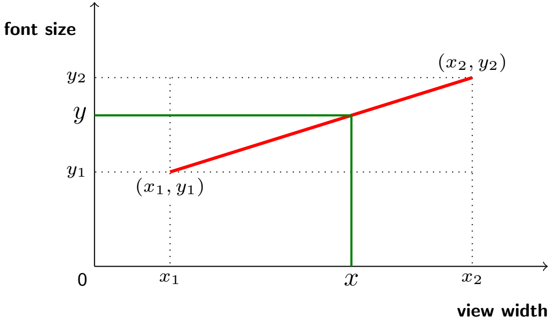

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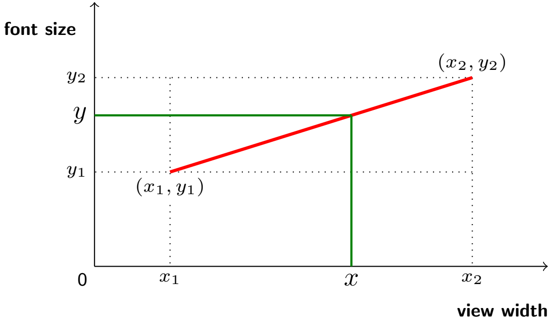

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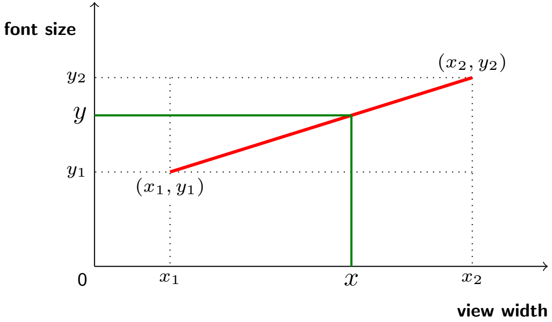
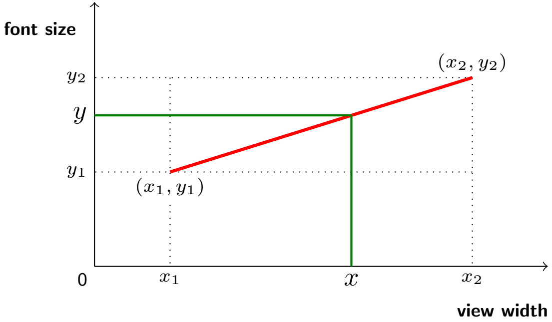
$$\Rightarrow y - y_1 = (x - x_1) \cdot \frac{y_2 - y_1}{x_2 - x_1}$$
$$\Rightarrow y = y_1 + (x - x_1) \cdot \frac{y_2 - y_1}{x_2 - x_1}$$



6 We have font size $= y_1 + (x - x_1) \cdot \dfrac{y_2 - y_1}{x_2 - x_1}$ where x_1, y_1, x_2 and y_2 are numbers chosen for our particular design and x is view width. Of course, CSS does not understand x but view width can be represented by 100vw.



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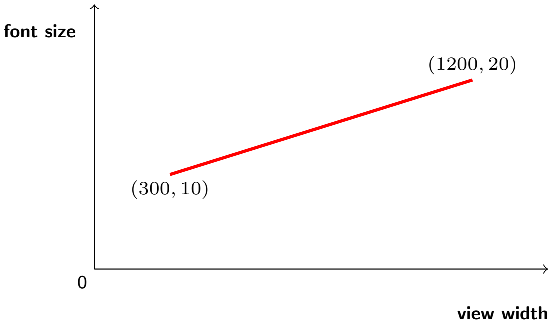
7 Thus, `font-size:calc(`y_1` + (100vw - `x_1`)*(`$y_2 - y_1$`)/(`$x_2 - x_1$`));`



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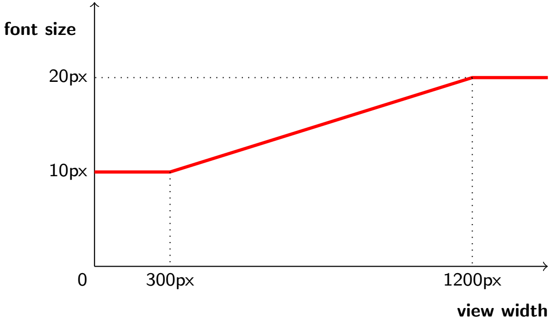
7 Thus, `font-size:calc(`y_1` + (100vw - `x_1`)*(`$y_2 - y_1$`)/(`$x_2 - x_1$`));`

8 From our previous example:

```
font-size:calc(10px + (100vw - 300px)*(20px-10px)/(1200px-300px));
```

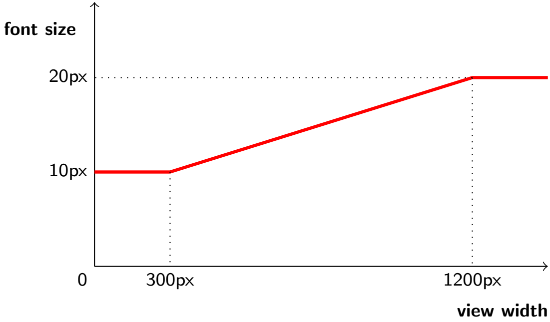
or, more concisely:

```
font-size:  calc(10px + 10 * (100vw - 300px)/900);
```



9 CSS for the complete range of view widths:

```
@media screen and (min-width:1200px) {
html { font-size:20px; }
}
@media screen and (max-width:1200px) {
html { font-size:  calc(10px + (100vw - 300px)/90); }
}
@media screen and (max-width:300px) {
html { font-size:10px; }
}
```



10 For ease of editing, using SASS variables for min-font, min-width, max-font, max-width is a better solution. Or write a mixin...