Formulas

The following formulas will be provided with the final exam:

- \( \cos^2(x) + \sin^2(x) = 1 \quad \tan^2(x) + 1 = \sec^2(x) \quad \cot^2(x) + 1 = \csc^2(x) \)
- \( \sin(x + y) = \sin(x) \cos(y) + \cos(x) \sin(y) \)
- \( \cos(x + y) = \cos(x) \cos(y) - \sin(x) \sin(y) \)
- \( \tan(x + y) = \frac{\tan(x) + \tan(y)}{1 - \tan(x) \tan(y)} \)
- \( \sin(2x) = 2 \sin(x) \cos(x) \)
- \( \cos(2x) = \cos^2(x) - \sin^2(x) = 2 \cos^2(x) - 1 = 1 - 2 \sin^2(x) \)
- \( \tan(2x) = \frac{2 \tan(x)}{1 - \tan^2(x)} \)
- \( \sin^2\left(\frac{x}{2}\right) = \pm \sqrt{\frac{1 - \cos(x)}{2}} ; \cos^2\left(\frac{x}{2}\right) = \pm \sqrt{\frac{1 + \cos(x)}{2}} ; \tan\left(\frac{x}{2}\right) = \frac{1 - \cos(x)}{\sin(x)} = \frac{\sin(x)}{1 + \cos(x)} \)
- Area of a triangle with sides of length \( a, b, \) and included angle \( \theta \): \( \frac{1}{2}ab \sin(\theta) \)
- \( \mathbf{a} + i\mathbf{b} = r(\cos(\theta) + i \sin(\theta)) \) where \( r = \sqrt{a^2 + b^2} \) and \( \tan(\theta) = \frac{b}{a} \)
- Work \( W \) of a force \( \mathbf{F} \) moving along a vector \( \mathbf{D} \): \( W = \mathbf{F} \cdot \mathbf{D} \)
- Parabola with focus \( (0, p) \) and vertex \( (0, 0) \):
  \[ x^2 = 4py ; \text{ Directrix: } y = -p \]
- Ellipse with foci \( (\pm c, 0) \) and vertices \( (\pm a, 0) \):
  \[ \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 , \quad (a > b > 0 ; c > 0) \]
  \[ c^2 = a^2 - b^2 ; \quad \text{Eccentricity: } e = \frac{c}{a} \]
- Hyperbola with foci \( (\pm c, 0) \) and vertices \( (\pm a, 0) \):
  \[ \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 , \quad (a > 0, b > 0) \]
  \[ c^2 = a^2 + b^2 ; \quad \text{Asymptotes: } y = \pm \frac{b}{a}x \]

Students are responsible for the formulas below:
- Change of a logarithmic base
- Continuous compounding, exponential growth and decay, doubling time and half-life
- Length of a circular arc, and area of a sector
- The Laws of Sines and Cosines
- Dot product, angle between two vectors. Direction, magnitude, and components of vectors.