

Show all your details work on separate sheet(s) (8½ x 11):**Part A: Polynomial & Rational Functions**

1. Determine the equation of the family of polynomial functions with zeros -2, 0, and 3.
2. **True or False:** -3 is a root of the polynomial function $f(x) = x^4 - 5x^2 + 12x + 16$.
3. **True or False:** $x + 2$ is a factor of the polynomial $x^3 - 5x^2 - 22x - 16$.
4. Determine the vertical asymptote of the reciprocal of $f(x) = 3x + 2$.
5. Determine the equation of the horizontal asymptote of $f(x) = \frac{4x - 3}{2x + 5}$.
6. **True or False:** $f(x) = \frac{x^2 - 9}{x - 3}$ has an oblique asymptote.
7. Use the factor theorem and long division to fully factor $x^3 + 9x^2 + 8x - 60$.
8. Determine an expression for $f(x)$ in which $f(x)$ is a quartic function, $f(x) > 0$ when $-3 < x < -1$, $f(x) \leq 0$ when $x < -3$ or $x > -1$, $f(x)$ has a double root when $x = 5$, and $f(4) = -70$.
9. The bacteria count, g , in thousands, for a sample of pond water, that is left to sit over time, t , in days can be modeled by the equation $g(t) = \frac{15t}{t^2 + 9}$, $t > 0$. When will the bacteria count be greater than one thousand? Round your answer to one decimal place.

Part B: Trigonometric Functions

1. Convert 115° to radians. Express your answer as a fraction of π , in lowest terms.
2. State the exact value of $\tan \frac{7\pi}{6}$.
3. Determine the value of $\sec 2.37$. Round your answer to 3 decimal places.
4. Determine the two exact radian values of θ , $0 \leq \theta \leq 2\pi$, for $\sin \theta = -\frac{\sqrt{3}}{2}$.
5. State the period, amplitude, vertical displacement and phase shift of the function $y = -2 \sin \frac{2}{3} \left(x - \frac{\pi}{6} \right) - 5$.
6. Determine the exact solutions of $2 \cos^2 x + \cos x - 1 = 0$ for x in the interval $0 \leq x \leq 2\pi$.
7. The population of blackflies at a lake in northern Ontario can be modeled by the function $P(t) = 23.7 \cos \left(\frac{\pi}{6}(t - 7) \right) + 24.1$, where P is in millions and t is in months. When is the population more than 40 million? Round answers to the nearest day.
8. Solve $\sin 2x + 2 \cos^2 x = 0$ for $0 \leq x \leq 2\pi$.