Name: _____ **Pre-Calculus 120 A**

Trigonometric Applications Worksheet

Applications of Sine & Cosine Functions

1. A girl jumps rope such that the height, h, in metres, of the middle of the rope can be approximated by the equation $h = 0.7\sin(72t + 9) + 0.75$, where t is the time, in seconds.
a) What is the amplitude of this function?
b) How many revolutions of the rope does the girl make in 1 min?

2. A population, p, of bears varies according to $p(t) = 250 + 30\cos t$, where t is the time, in years, and angles are measured in radians.
a) What are the maximum and minimum populations?
b) What is the first interval, in years and months, over which the population is increasing?

3. Wilson places a measuring tape on a pillar of a dock to record the water level in his local coastal community. He finds that a high tide of 1.77 m occurs at 5:17 a.m., and a low tide of 0.21 m occurs at 11:38 a.m.
a) Estimate the period of the fluctuation of the water level.
b) Estimate the amplitude of the pattern.
c) Predict when the next two high tides will occur.
d) Predict when the next two low tides will occur.

4. A windmill has blades that are 20 m in length, and the centre of their circular motion is a point 23 m above the ground. The blades have a frequency of 4 revolutions per minute when in operation.
a) Graph the function over two complete cycles.
b) Use a sinusoidal function to model the height above the ground of the tip of one blade as a function of time.
c) How far above the ground is the tip of the blade after 10 s?

5. A mass is suspended by a spring such that it hangs at rest 0.5 m above the ground. The mass is raised 40 cm and released at time $t = 0$ s, causing it to oscillate sinusoidally. The mass returns to the high position every 1.2 s.
a) Write an equation that models the mass's height, h, as a function of time, t.
b) Determine the height of the mass above the ground at $t = 0.7$ s.

6. A Ferris wheel of diameter 18.5 m rotates at a rate of 0.2 rad/s. If passengers board the lowest car at a height of 3 m above the ground, determine a sinusoidal function that models the height, h, in metres, of the car relative to the ground as a function of the time, t, in seconds.

7. The flapping of a bird's wing can be modelled by the function $y = 5\sin 7200t + 5$, where y represents the distance the tip of the wing travels, in centimetres, and t represents the time, in seconds.
a) Determine the period of the motion of the wing (1 full flap).
b) Determine the amplitude, the minimum value, and the maximum value.
c) Determine the position of the wing tip at $\frac{1}{60}$ s. Round to the nearest tenth of a cm.
d) What are the first times after $t = 0$ that the tip of the wing reaches the minimum and maximum values?