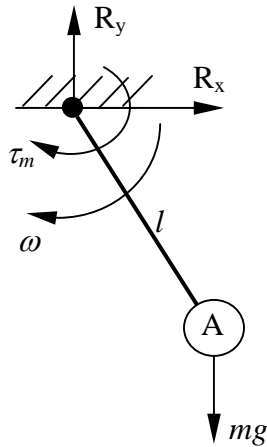


MECH 3140 Pre-Requisite Quiz Material

Name: _____

A motor rotates a pendulum (of length l and mass m) at a **constant** rotational velocity (ω).



1) Calculate the velocity of point A (magnitude and direction).

2) Calculate the acceleration of point A (magnitude and direction).

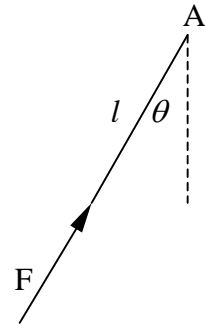
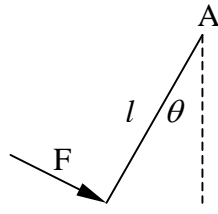
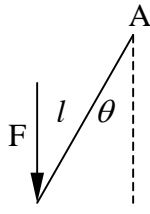
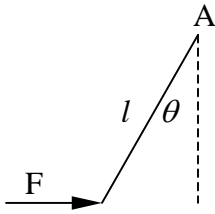
3) What is the Reaction Force R_x equal to (at the instant shown in the figure)?

- a) $R_x = 0$
- b) $R_x > 0$
- c) $R_x < 0$

4) What is the Reaction Force R_y equal to (at the instant shown in the figure)?

- a) $R_y = mg$
- b) $R_y > mg$
- c) $R_y < mg$

5) Calculate the Moment about point A for each of the following cases.



6) Is $x(t) = \sin(2t) + 2$ a solution to $\ddot{x} + 4x = 8$? Note: $\dot{x} = \frac{dx}{dt}$ and $\ddot{x} = \frac{d^2x}{dt^2}$

7) Solve the differential equation $\dot{x} + 4x = 8$ where $x(0) = 0$

8) If x is position, what does the solution represent physically?

9) Write the polynomial equation that has 2 roots at $s=5$ and $s= -10$;

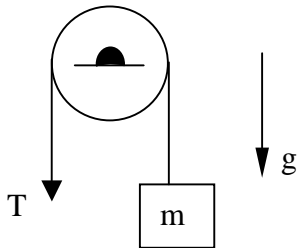
Given $f = \theta \sin(\theta)$, where $\theta = \theta(t)$

10) Calculate: $\frac{df}{d\theta}$

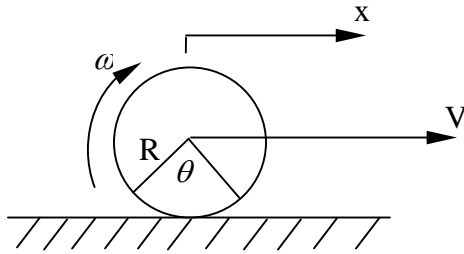
11) Calculate: $\frac{df}{dt}$ (Hint: $\dot{\theta} = \frac{d\theta}{dt}$)

12) The equation $f = \sin(60t)$, where t is in seconds, has how many cycles in one second?

13) Ignoring losses in the pulley, calculate the tension in the rope to accelerate the block upward at 1 m/s^2



A wheel of radius R rolls with a rotational velocity ω without slipping



14) Relate V and ω

15) Relate x and θ

16) Draw the free body diagrams for the ball (of mass m) and the beam (of mass M) shown below:

