

# Supernova

## Introduction

This ride is a swing carousel. You sit in a chair suspended from a frame that can rotate, but before it begins to rotate, the frame rises up the central column



The ride involves circular motion after an initial increase in gravitational potential energy.

## Data supplied:

Radius of frame = 4.7 m.

Length of metal wire from frame to chair = 6.9 m

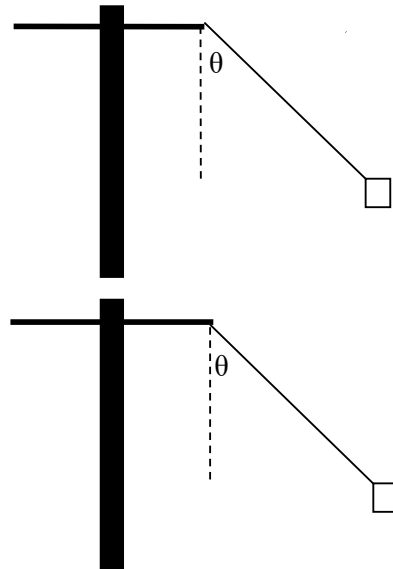
Radius of chair's rotation = 10.5 m

## Measurement to be taken from the ground:

Period of the circular motion =

## Force Drawings

- 1) The figure on the right shows the chair at an angle as it moves around in a circle. Draw an arrow for each force acting on the chair. Begin each arrow at the chair with the head of the arrow showing the direction of the force.
- 2) Label each arrow in the form 'Force on A by B' and include the symbol for each force.
- 3) Draw an arrow showing the direction of the acceleration of the chair.



## Relationships

- 4) Using your diagram above, write expressions for:
  - a) The net force in the vertical direction.

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- b) The net force in the horizontal direction

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## Speed and Centripetal Acceleration

- 5) Use the value of the radius of the chair's motion and your measurement of its period to calculate the speed of the chair. (Show working and include the units.)

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- 6) Use the value of the radius of the chair's motion and your measurement of its period to calculate the chair's centripetal acceleration. (Show working and include the units.)

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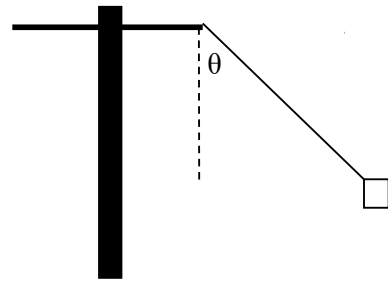
**Angle and Tension**

- 7) Enter the supplied data on the figure on the right and calculate the angle,  $\theta$ , the wire makes with the vertical. (Show working.)

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- 8) Assuming each chair has a mass of 50 kg, Use your answer to Q'n 7 to determine the tension in the wire when both chairs are occupied with passengers, whose total mass is 120 kg. (Show working and include the units.)

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**Dropping things**

- 9) If, while revolving around in your chair at the top of the ride, you dropped your phone. you are 22 m above the ground, determine how far from the column it would land.

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- 10) If you were directly above Pharoah's Curse when you dropped the phone, in what direction from the column would it land?

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**What if Question**

- 11) There is one main cable that supports two chairs. If the empty chair beside you dropped off the cable, how would your motion change? Explain your answer.

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