Part A: Multiple Choice

1) e
2) d
3) c
4) d
5) d
6) c
7) d
8) d
9) e
10) d
11) a
12) d
13) a

Part B: Questions

1a) $x_6 = x_o + \Delta x = 70$ m
1b) $v = 0$, at 5s, 11s
1c) $a_{11} = 10\ m/s^2$
1d) The particle is moving in the negative x-direction (backwards) and is slowing down (the acceleration is in opposite direction to the velocity).
1e) Particle #1, $\Delta x = (v\text{-}t)$ area = 40 m (in 4s)
Particle #2, $v_o = 0, \Delta t = 4$s
$\Delta x = v_o \Delta t + 1/2 a \Delta t^2$, $a = 5$ m/s^2 (slope of v-t graph)

2) $h = 20.3$ m
3a) $w = 31.4$ rad/s
3b) $\alpha = -2.62$ rad/s^2
3c) $\Delta\theta = 189$ rads or 30.0 revs
3d) $a_r = 197$ m/s^2, $a_t = 1.60$m/s^2, $a = 197$ m/s^2

4) Draw the Free Body Diagram first

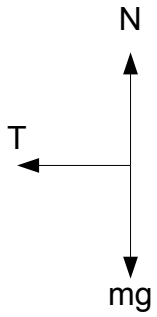
Horizontal: $\sum F_x = 0,\ T_2 cos\theta_2 = T_1 cos\theta_1$ (1), $\quad \therefore T_2 = T_1 \dfrac{\cos\theta_1}{\cos\theta_2}$

Vertical: $\sum F_y = 0,\ [T_2 sin\theta_2 + T_1 sin\theta_1] = mg$ (2)
Sub T_2 into (2)

5) At- top: $N_t = ma_r - mg$
At-bottom: $N_b = ma_r + mg$ Since $N_b > N_t$, the pilot feels heavier at the lowest point.

6) a = 1.53 m/s^2

7a)



7b) l = R = 0.955 m
7c) T = 9.16 N
8) x = 0.135 m
9a) v = 3.24 m/s at 312^o
9b) F_{max} = 292 N

10a) As the ball falls down the work done by gravity is positive and the kinetic energy increases, as $\Delta K = W_g$, (also the loss in potential energy is equal to the gain in kinetic energy).

10b) Momentum is conserved when the ball hits the cart, and the initial momentum of the ball is "shared" between the ball and the cart. The collision is not elastic, so kinetic energy is lost in the collision (mainly converted to heat).

10c) As the ball swings back up work done by gravity is negative, so the kinetic energy decreases by the same amount. (Also the loss in potential energy will be converted to potential energy). As the cart moves away after the collision it's kinetic energy will remain constant, unless there is a loss due to work done by friction.

11) F_{net} = 90.4N at 206^o