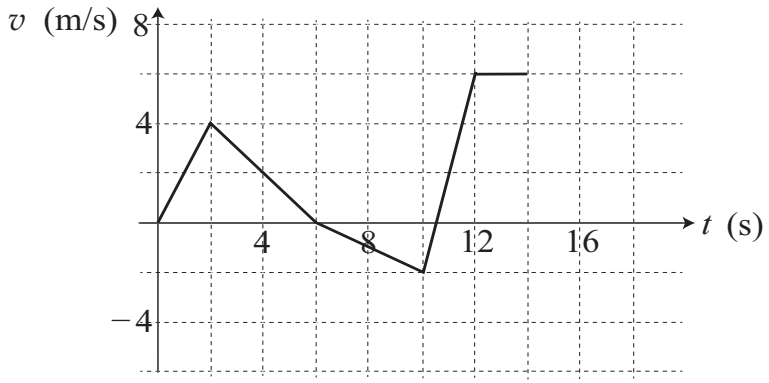
Physics 101 (F11) **Q2A**

Name: _____ **Section:** _____ **Score:** _____/20

1. A cart of mass 2.5 kg is moving along the x-axis. Its velocity (x-velocity) as a function of time is graphed below.



(a) What is the average velocity of the cart between time 0 and 14 seconds? [4]

(b) What is the maximum magnitude of the (total) force acting on the cart before 14 s? [4]

(c) Immediately after 14 s a brake is applied, and the cart experiences a constant acceleration of -1.5 m/s^2. Continue the velocity graph beyond 14 s until the cart comes to a halt. [2]

(**2** on the next page)

2. A toy rocket is fired vertically with zero initial velocity from the ground with a constant acceleration a (m/s^2). After 2 s the fuel is exhausted. Still the rocket continues to go up (ignore air resistance; only gravity acts on the rocket). After 3 s (i.e, 5 s after launching), the rocket reaches its highest point.

(a) What is the acceleration a? [5]

(b) What is the vertical distance the rocket traverses after exhausting its fuel until it reaches the highest point? If you are not sure about your answer to (a), you may use a as a symbol in your answer. [5]

Physics 101 (F11) **Q2B**

Name: _____ **Section:** _____ **Score:** _____**/20**

1. A cart of mass 1.7 kg is moving along the x-axis. Its initial position is $x = 0$ (m). Its velocity (x-velocity) as a function of time is graphed below.

(a) The cart eventually stops. What is its final position (x-coordinate)? [4]

(b) What is the maximum magnitude of the (total) force acting on the cart? [4]

(c) If the magnitude of the acceleration (actually, the deceleration) is doubled beyond 6 s, when does the cart come to a halt? (Answer by drawing (i.e., revising) the time velocity graph beyond 6 s.) [2]

(**2** on the next page)

2. On a planet is a tower of height h (m). A ball is thrown vertically upward with an initial speed of 4 m/s from the top of the tower. The ball reaches the highest point after 6 s, and then it lands on the ground 9 s later (i.e., 15 s after the ball is thrown upward).

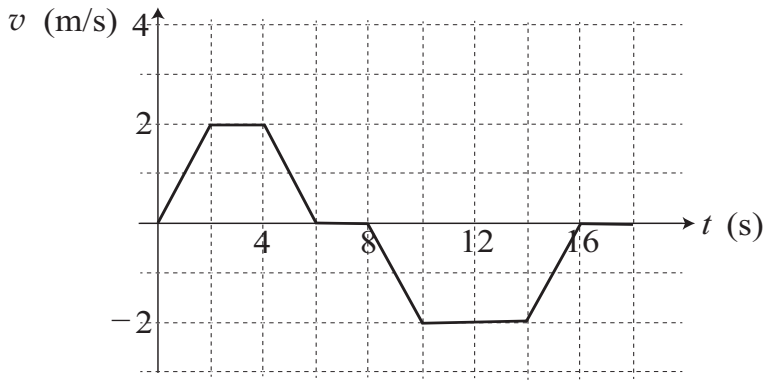
(a) What is the acceleration of gravity g_0 of this planet? [5]

(b) What is the height h of the tower? If you are not sure about your answer to (a), use g_0 as a symbol in your answer. [5]

Physics 101 (F11) **Q2C**

Name: _____ **Section:** _____ **Score:** _____**/20**

1. The vertical velocity (upward positive) of an elevator is graphed in the following. The height (position) of the elevator floor is initially $z = 0$ (m).



(a) What is the height of the elevator floor at the first stop? [4]

(b) What is the average velocity of the elevator between time 0 and 12 s? [4]

(c) Unfortunately, the elevator cable snaps at time 2 s and it falls freely. Sketch the velocity of the elevator in this unfortunate case as a function of time after 2 s in the graph (approximately quantitatively). [2]

(**2** on the next page)

2. A ball is thrown down from the top of a building of height H (m) with an initial speed of v_0 (m/s). At the half height $H/2$ of the building, the speed of the ball is 25 m/s. When the ball reaches the ground, the speed of the ball is 30 m/s.

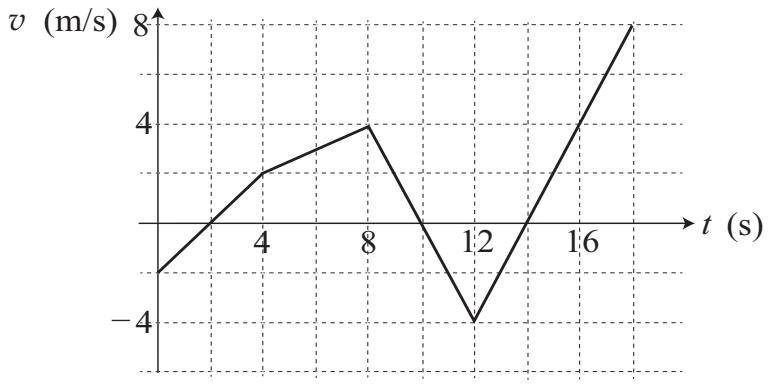
(a) What is the height H of the building? [5]

(b) What is the initial speed? If you are not sure about your answer to (a), you may use H as a symbol in your answer. [5]

Physics 101 (F11) **Q2D**

Name: _____ **Section:** _____ **Score:** _____/20

1. A cart of mass 3.1 kg is moving along the x-axis. Its velocity (x-velocity) as a function of time is graphed below.



(a) What is the average velocity of the cart between 0 and 18 s? [4]

(b) What is the maximum magnitude of the (total) force acting on the cart? [4]

(c) When does the cart return to the starting point (its position at $t = 0$)? [2]

(**2** on the next page)

2. From the top of a tower of height H, a ball is vertically thrown upward with an initial speed 21 m/s. The ball reaches the ground 2 s after returning to the height of the tower (i.e., the initial position).

(a) What is the height H of the tower? [5]

(b) What is the total traveling time of the ball since it is initially thrown upward? [5]