**2- Correction key**

1

B

2

C

3

B

4

A

5

D

6

A

7

D

8

C

9

Work : (example)

At *t* = 0 s *v*i or *v*o = 40 m/s

the cart slows at a rate of 2.5 m/s2 => *a* = -2.5 m/s2

and , we want to know when *v*f or *v* = 0

Since *v*f = *a*Δ*t* + *v*i or *v* = *at* + *v*o

=> or 

=> or 

Result : 16 s

10

|  |  |
| --- | --- |
| **Example of an appropriate and complete answer**  Areas under slopes  *d*1 (0 s to 5 s) =  • 5 s = 62.5 m  *d*2 (5 s to 10 s) = (15 m/s)(5 s) = 75 m  *d*3 (10 s to 15 s) == 37.5 m  *d*4 (15 s to 20 s) = = -25 m  *d*5 (20 s to 25 s) = (−10 m/s)(5s) = −50 m |  |
| *d*Total = 62.5 m + 75 m + 37.5 m + (−25m) + (−50m) = 100 m | |

**Answer: The displacement at the end of 25 seconds is 100 m.**

13

**Example of an appropriate and complete answer**

Determine distance from top to stall: *t* = 130 s to *t* = 200 s

Area = (½ × 8 m/s × 20 s) + (8 m/s × 50 s)

= 480 m

Determine distance from stall to bottom: *t* = 200 s to *t* = 260 s

Area = (8 m/s × 50 s) + (½ × 8 m/s × 10 s)

= 440 m

Closer to the bottom by: 480 m − 440 m = 40 m

**Answer:** At time *t* = 200 s, the ski lift is closer to the **bottom** by **40 m**.

14

B

15

C

16

C

17

B

18

112 m

19

**Example of an appropriate and complete answer**

**Solution**: ***Malfoy***

** = * + 2a*Δ*d*

** = (-2)2 + 2(-9.8)(-20)

** = 4 + 392

** = 396

** = 19.9 m/s down or -19.9 m/s

*v*2 = *v*1 + *a*Δ*t*

-19.9 = -2 + (-9.8)Δ*t*

Δ*t* = 1.8 sec.

***Potter***

*v* = 

25 = 

Δ*t* = 3 sec.

3 s – 1.8 s = 1.2 sec.

**Answer:** Malfoy will be first to reach the snitch with **1.2 s** to spare!

20

**Example of an appropriate and complete answer**

Time needed to reach max. height

*v*2 = *v*1 + *a*Δ*t*

0 = -5.00 m/s + (9.8 m/s2) Δ*t*

Δ*t* = 

Δ*t* = 0.510 seconds to reach max. height

Distance from release to max. height

Δ*d* = 

Δ*d* = 

Δ*d* = 1.28 m

Distance from max. height to ground

1.28 m + 12.0 m = 13.28 m

Time needed to fall from max. height to ground

Δ*d* = *v*1*t* +  *a*Δ*t*2

13.28 m = (0 m/s) *t* +  (9.8 m/s2) Δ*t*2

Δ*t*2 = 

Δ*t* = 

Δ*t* = 1.65 seconds to fall from max. height to ground

Total time to reach max. height and fall to ground is 0.510 s + 1.65 s = 2.16 s

**Answer:** The time it takes the ball to hit the ground from the instant it is released is **2.16 s**.

Note: A solution using the quadratic equation is acceptable.

1

At Sanair Speedway, a dragster, starting from rest, accelerates at a constant rate of 8.00 m/s2.

How much time does it take for it to cover the first 100 metres?

|  |  |
| --- | --- |
| A) | 4.0 s |
| B) | 5.0 s |
| C) | 10.0 s |
| D) | 12.5 s |

2

An automobile, accelerating at a rate of 3.00 m/s2, increases its velocity from 10.0 m/s to 22.0 m/s.

What distance did it travel during this time?

|  |  |
| --- | --- |
| A) | 128 m |
| B) | 72.0 m |
| C) | 64.0 m |
| D) | 36.0 m |

3

A car is travelling in a straight-line path. The change in its position as a function of time is shown on the following graph.



When will the car have the greatest velocity?

|  |  |
| --- | --- |
| A) | Only at time *t*1 |
| B) | Between time 0 and time *t*1 |
| C) | Only at time *t*2 |
| D) | Between times *t*1 and *t*2 |

4

The following is a graph of velocity as a function of time of a car travelling in a straight-line path.



What is the average acceleration of the car during the first 10 seconds?

|  |  |
| --- | --- |
| A) | 1 m/s2 |
| B) | 3 m/s2 |
| C) | 6 m/s2 |
| D) | 10 m/s2 |

5

A train travels the distance from city A to city B in 2 h 30 at a constant velocity of 80 km/h.

How much time will it take the train to return from city B to city A if its velocity is reduced to 60 km/h?

|  |  |
| --- | --- |
| A) | 3 h 45 |
| B) | 3 h 40 |
| C) | 3 h 30 |
| D) | 3 h 20 |

6

A skunk, M, is searching for food. The diagram below represents the skunk's successive displacements.



Which vector represents the resultant displacement of the skunk, M?

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| A) |  | B) |  | C) |  | D) |  |

7

In an open field, two soccer players (X and Y) are passing the ball in the directions shown in the diagram below.



Player X passes the ball to player Y, then continues running to position X’.

Player Y passes the ball to player X who has reached position X’, he then continues running to position Y’.

Player X passes the ball back to player Y who has now reached position Y’.

Which of the following vectors represents the total displacement of the ball?

|  |  |  |  |
| --- | --- | --- | --- |
| A) | Vector I | C) | Vector III |
| B) | Vector II | D) | Vector IV |

8

The International Space Station (ISS) orbits in space at a velocity of 7.6 km/s. During one of their missions, the astronauts onboard the station launched a satellite with a velocity vector, as shown below. Seconds after the launch, the satellite stopped working. A rocket was immediately launched from Earth to retrieve the satellite.

|  |  |
| --- | --- |
|  | Given the following:  • The escape velocity of the rocket to leave Earth’s gravitational pull is 11.3 km/s vertically.  • The space station was directly over the rocket-launching platform **at the time the space station was launched**.  • The magnitude of the satellite’s velocity vector is less than that of the space station. |

Which of the following velocity vectors represents the direction that the rocket takes to reach the disabled satellite?

|  |  |  |  |
| --- | --- | --- | --- |
| A) |  | C) |  |
| B) |  | D) |  |

9

John and Melanie carry out a motion experiment with a cart and construct the following graph of the velocity as a function of the time.

Distracted, they forgot to note the time that the cart stopped.



Knowing that the cart slowed at a rate of 2.5 m/s2, how long did it take to stop?

Show your work.

10

The motion of an object is represented by the following velocity-time graph.



Determine the object's displacement at the end of 25 seconds.

13

|  |  |
| --- | --- |
| A ski lift moves up and down along a hill according to the following *V*-*t* graph. Unfortunately, it stalls on the way **down** at *t* = 200 s.  At this point, the rescue team must decide whether the skiers are closer to the top or the bottom of the hill.  Using the *V*-*t* graph, determine whether the ski lift is closer to the top or to the bottom of the hill and by how much. |  |

**Ski Lift Velocity Graph**



14

A car is driving in a straight-line path. Its change of position as a function of time is given by the following graph.



What is the displacement of the car from 0 to 13 seconds?

|  |  |
| --- | --- |
| A) | 10 m |
| B) | 20 m |
| C) | 40 m |
| D) | 60 m |

15

The following graph shows the position as a function of time of a cyclist going in a straight-line path.



What is the velocity of the cyclist at 25 seconds?

|  |  |
| --- | --- |
| A) | 125 m/s |
| B) | 2 m/s |
| C) | -5 m/s |
| D) | -50 m/s |

16

Under the influence of gravity, an apple falls to the ground.

Which of these graphs shows the position of the apple as a function of time as it falls to the ground?

(down is positive)

|  |  |  |  |
| --- | --- | --- | --- |
| A) |  | C) |  |
| B) |  | D) |  |

17

Which of the following graphs represents the magnitude of the velocity of an object in free fall?

|  |  |  |  |
| --- | --- | --- | --- |
| A) |  | C) |  |
| B) |  | D) |  |

18

An object fell from rest on Planet X where *g* = 14 m/s2. It was in free-fall for 4.0 seconds. The acceleration-time graph is shown below.



How far did the object fall?

19

During a Quidditch match, Potter and Malfoy are chasing the snitch. Trying to catch the snitch first, Malfoy dives off his broom at 2 m/s [Down], from a height of 20 m from the snitch, while Potter is racing towards the snitch at a constant speed of 25 m/s for 75 m.

Who will make it to the snitch first and with how much time to spare? (*Assume the snitch is at rest*.)

