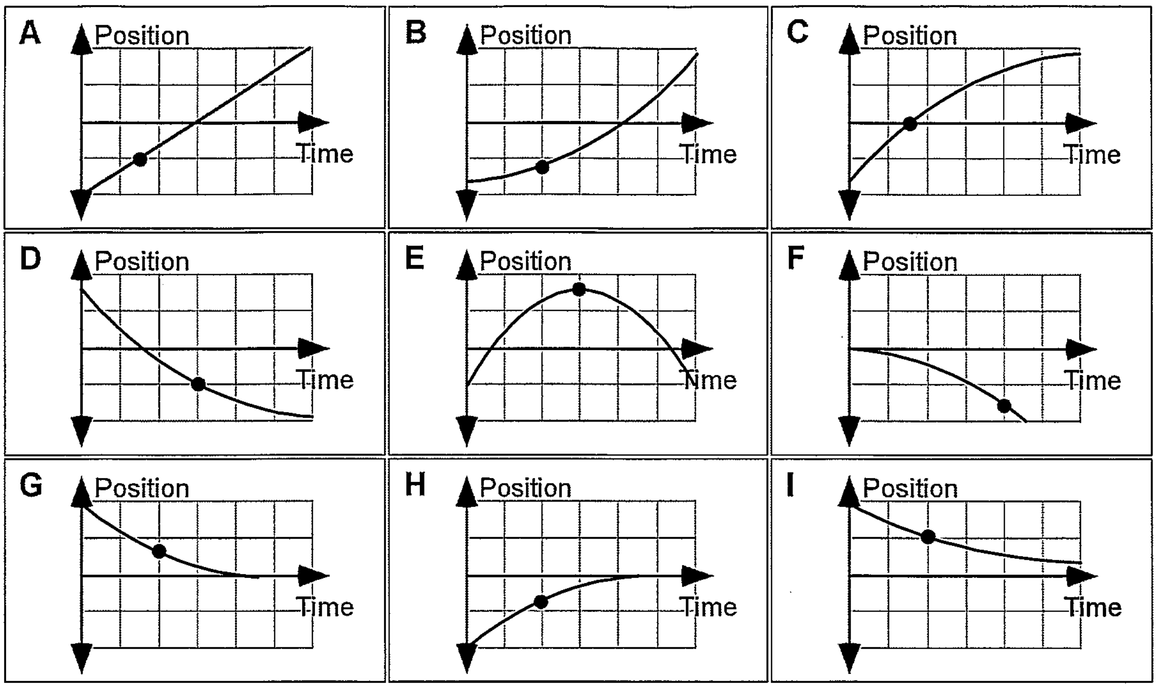
4.



a) For which of these, if any, is the position zero at the indicated point? C

b) For which of these, if any, is the position negative at the indicated point?

A, B, D, F, H

c) For which of these, if any, is the velocity zero at the indicated point?

E

d) For which of these, if any, is the velocity negative at the indicated point?

D, F, I, G

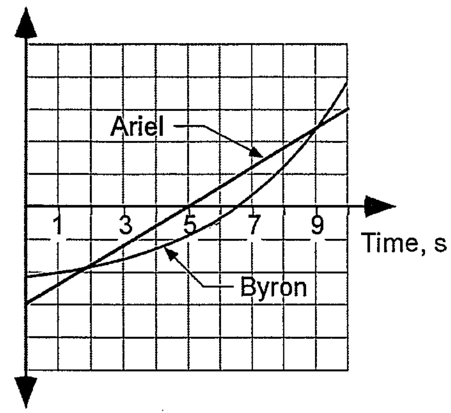
e) For which of these, if any, is the acceleration zero at the indicated point?

A

f) For which of these, if any, is the acceleration negative at the indicated point?

C, E, F, H

5. The graph at right is of the motion of two children, Ariel and Byron, who are moving along a straight hallway. <u>The vertical axis is not labeled intentionally.</u>



a) If the vertical axis is position, does either child ever change direction? If so, at what time or times does this change in direction occur?
Explain.

They do not change direction
move from - to + direction

b) If the vertical axis is position, are the two children ever at the same position along the hallway? If so, at what time or times?
Explain.

t = 2s and 9s   lines cross

c) If the vertical axis is position, do the two children ever have the same velocity? If so, at what time or times?
Explain.

t = 6 seconds
Slope of curve is same as slope of line

d) If the vertical axis is position, do the two children ever have the same acceleration? If so, at what time or times?
Explain.

No
Ariel never accelerates
Byron always does

e) If the vertical axis is velocity, do either of the children ever change direction? If so, at what time or times does this change in direction occur?
Explain.

Yes   A = 5s
B = 6.5s
cross x-axis

f) If the vertical axis is velocity, do the two children ever have the same velocity? If so, at what time or times?
Explain.

t = 2s and 9s

6. Three students are discussing a situation where a bicyclist travels at a steady 18.0 m/s for 10 minutes, then at 6.0 m/s for 20 minutes and finally at 12.0 m/s for 15 minutes along a straight level road. Students make the following contentions about the bicyclist's average speed for the overall trip:

Aaron: "I think the average speed for the entire period is 18 m/s because to find an average you sum the three values and divide by two."

Bessie: "I disagree. The average speed is 12 m/s because you add the three velocities, but then you have to divide by three."

Cesar: "No, you are both wrong. The average speed is 10.7 m/s because that is what you get when you divide 28,800 m, the total distance traveled on the straight road, by 2700 seconds, the total time it took."

Which, if any, of these three students do you agree with?

Aaron_____ Bessie _____ Cesar ✓ None of them ~~X~~

Please explain your reasoning.

$18\frac{m}{s}(10\,min)\left(\frac{60\,sec}{1\,min}\right) = 10{,}800\,m$

$6.0\frac{m}{s}(20\,min)\left(\frac{60\,sec}{1\,min}\right) = 7200\,m$

$12\,m/s\,(15\,min)\left(\frac{60\,sec}{1\,min}\right) = 10\,800$

} 28800 m

$10\,min\,(60) = 600\,s$

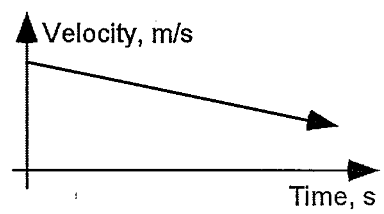
$20\,min\,(60) = 1200\,s$ (~~360 s~~)

$15\,min\,(60) = 900$ (~~720~~)

} ~~1680 s~~ 2700

$V_{av} = \frac{m}{s} = \frac{28800\,m}{\text{~~1680 s~~}\ 2700} =$ ~~17.1 m/s~~ 10.7 m/s

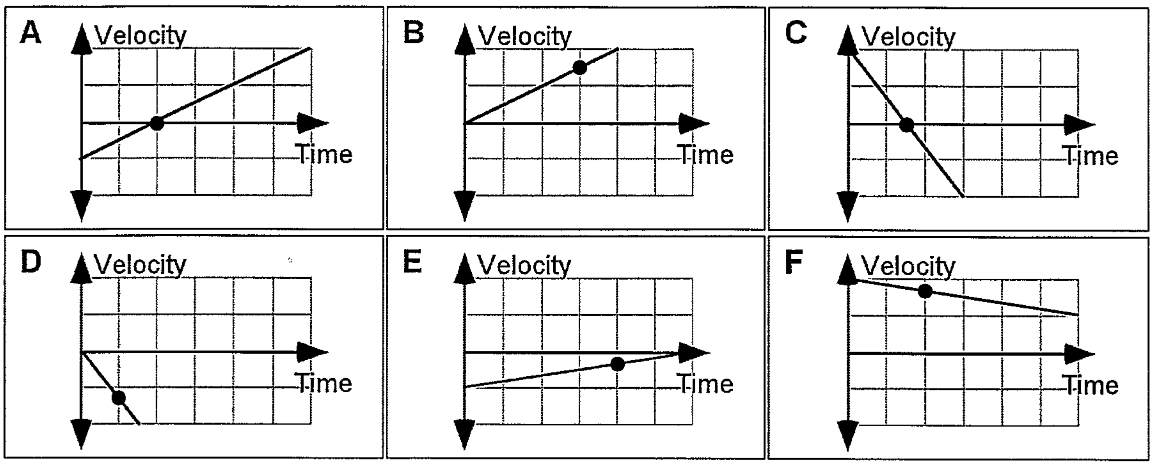
7. A bicyclist moving at high speed on a straight road comes to a hill that slopes upward gradually. She decides to coast up the hill. A physics student observing the bicyclist plots the velocity-time graph for her trip up the hill as shown.



What, if anything, is wrong with this student's graph? If something is wrong, explain the error and how to correct it. If the graph is correct, explain why.

starts w/ high V. As she ~~cost~~ coasts up her V slowly decreases at a constant acceleration eventually she will come to a stop + slide backwards

8. The graphs below show the velocity versus time for six boats traveling along a narrow channel that runs east to west. The scales on both axes are the same for all of these graphs, and east is positive. In each graph, a point is marked with a dot.



A) Rank these situations on the basis of the velocity of the boat at the point indicated.

Greatest 1 B 2 = F 3 A 4 = C 5 E 6 D Least

OR, The velocity at the marked points is the same but not zero for all these boats. B + F

OR, The velocity at the marked points is zero for all these boats. A, C

OR, We cannot determine the ranking for the velocity of these boats. ___

Please explain your reasoning.

B) Rank these situations on the basis of the acceleration of the boat at the point indicated.

Greatest 1 A 2 = B 3 E 4 F 5 D 6 = C Least

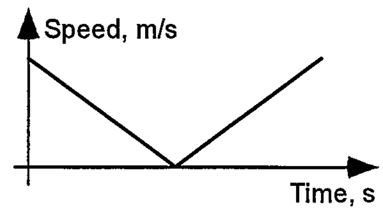
OR, The acceleration at the marked points is the same but not zero for all these boats. A & B, C and D

OR, The acceleration at the marked points is zero for all these boats. None

OR, We cannot determine the ranking for the accelerations of these boats. ___

Please explain your reasoning.

9. A ball is thrown straight upward and falls back to the same height. A student makes the graph of the speed of the ball as a function of time. Three students who are discussing this graph make the following contentions:



Akira: "I don't think this can be correct because the sign of the acceleration changes on this graph, but the acceleration on the ball will be constant."

Burt: "No, I think this is right because it is only showing what happens to the speed, which will decrease to zero at the top and then increase as the ball falls. Since the slopes for both segments are the same except for sign that means the acceleration is constant."

Catalina: "This graph makes sense to me because it shows the speed decreasing. I disagree with Burt, because I think this means the acceleration is also decreasing until the ball gets to the top and stops. Then both the speed and acceleration increase as the ball falls down again."

Which, if any, of these three students do you agree with and think is correct?

Akira _____ Burt __X__ Catalina _____ None of them______

Please explain your reasoning.

10. An object moves along the x-axis according to this expression (with x in meters and t in seconds):

A) Describe the motion of the object of that is represented by the equation below and draw a x-t and v-t graph.

16 - 8 + 8

$$x = 10 - 4t + 2t^2$$

10 - 12 + 18

acceleration is: $\frac{1}{2}a = 2$

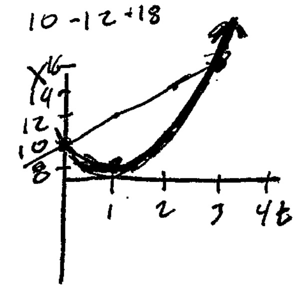
$a = 4 m/s$

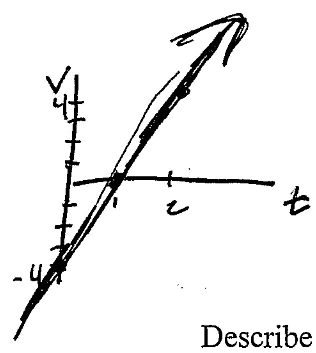
V_0: $V_0 t = -4t$

$V_0 = -4$

X_0 - initial position

$X_0 = 10$





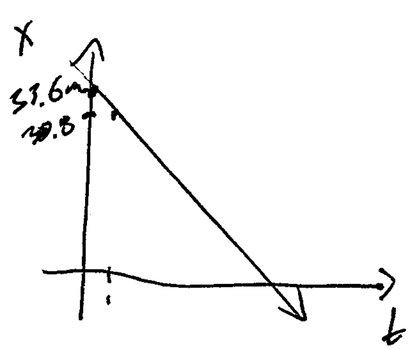
B) Describe the motion of an object that is represented by the equation below and draw a x-t and v-t graph.

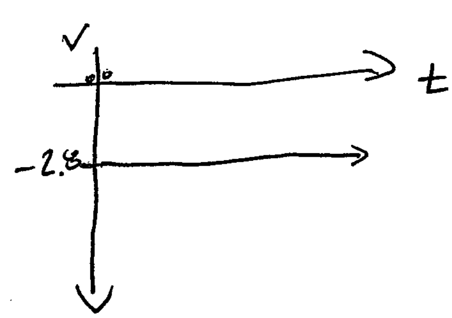
$$x = 33.6\text{ m} - (2.8\text{ m/s})t$$

$X_0 : 33.6 m$

$V_0 : -2.8 m/s$

$a = 0$



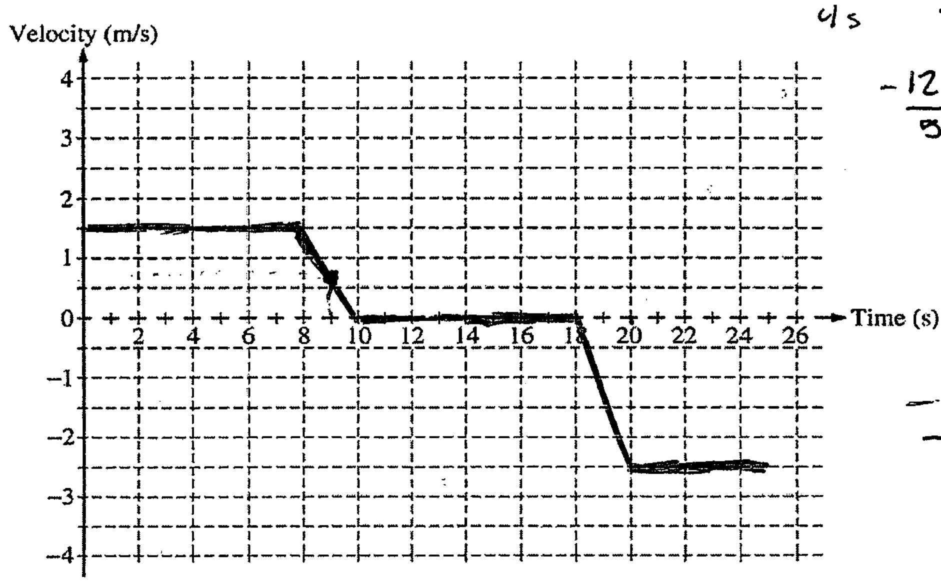


2. The vertical position of an elevator as a function of time is shown above.

a. On the grid below, graph the velocity of the elevator as a function of time.

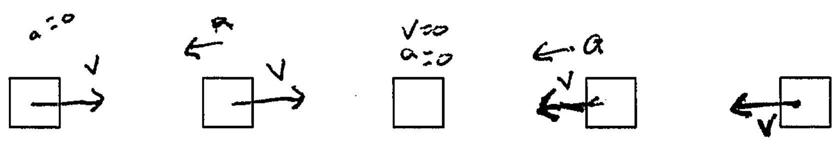
$\frac{6m}{4s} = \frac{3 m/s}{2} = 1.5 m/s$

$\frac{-12m}{5s} = -2.4 m/s$



$\frac{-2.5}{2} = -1.25$

b. On the boxes below that represent the elevator, draw a vector to represent the direction of the velocity and acceleration at 6s, 9s, 12s, 19s, and 22s.



Name: KEY

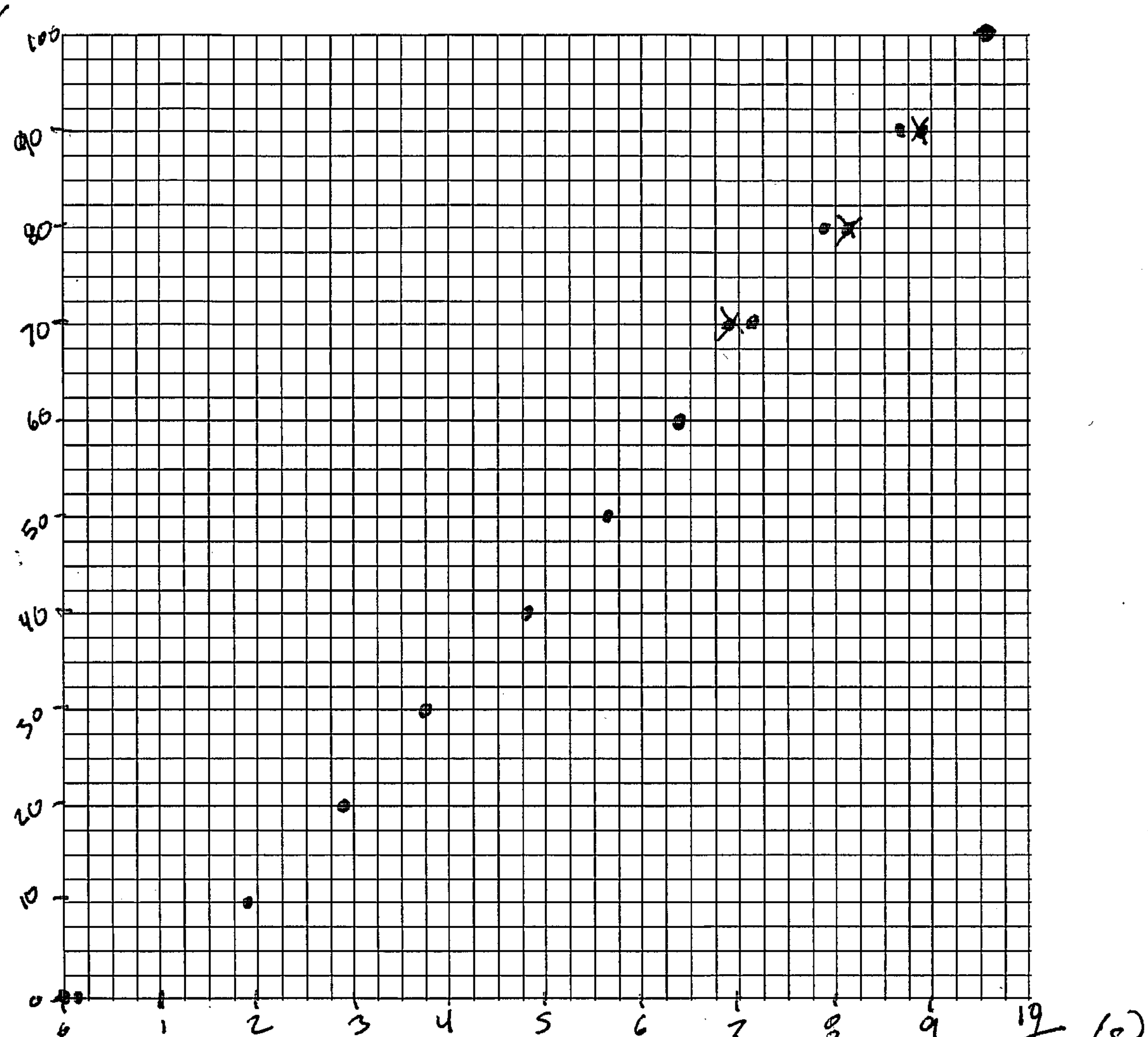
AP Physics 1:
1D Motion Review

1. During the 2009 Track and Field Championships, Usain Bolt set the world record in the 100m at 9.58s. Past studies have shown that runners in such a race accelerate uniformly for a time a short time and then run at constant speed for the remainder of the race.

Bolt's reaction time during the sprint was 0.146s.

Below are the data from the race:

Position	Time
0	0.00
10	1.89
20	2.88
30	3.78
40	4.64
50	5.47
60	6.29
70	7.10
80	7.92
90	8.75
100	9.58



A) Use the grid above to graph the appropriate data data

B) Determine the sprinter's constant acceleration during the first 2 seconds in two different ways.

11. An object is dropped from rest from the top of a 400m cliff on Earth. If air resistance is negligible, what is the distance the object travels during the first 6s of its fall.

12. A car starts from rest and accelerates uniformly over a time of 5.21 seconds for a distance of 110 m. Determine the acceleration of the car.

13. A stoplight turns yellow when you are 20 m from the edge of the intersection. Your car is traveling at 12 m/s; you hit the brakes after 0.5s, the car's speed decreases at a rate of 6.0 m/s each second. Do you stop in time?

Questions 14 through 16: Examine the equations below, which represent either the **position or velocity** of an object as a function of time. Choose the correct function(s) for each of the descriptions of motion below. You may use a function more than once or not at all.

- *I* $x(t) = 7\ (\text{m/s})\ t + 1\ (\text{m/s}^2)\ t^2$
- *II* $x(t) = 25\ (\text{m}) + (-6\ \text{m/s})\ t$
- *III* $x(t) = -3\ (\text{m}) + (-15\ \text{m/s})\ t + (-1.8\ \text{m/s}^2)\ t^2$
- *IV* $v(t) = -4\ (\text{m/s})$
- *V* $v(t) = 5\ (\text{m/s}) + (-1/2\ \text{m/s}^2)\ t$

14. An object is moving in the positive direction but is slowing.

A. *II* only
B. *IV* only
C. *V* only
D. Both *II* and *IV*
E. Both *I, III,* and *V*

15. An object is moving at a constant speed in the negative direction.

A. *II* only
B. *III* only
C. *IV* only
D. Both *II* and *IV*
E. Both *III* and *V*

16. An object starts with an initial velocity and is speeding up.

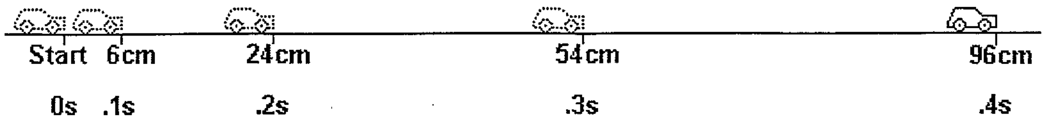
A. *I* only
B. *II* only
C. *III* only

D. *V* only

E. Both *I* and *III*

Questions 17-18

The diagram below represents a toy car starting from rest and uniformly accelerating across the floor. The time and distance traveled from the start are shown in the diagram.



17. What was the acceleration of the cart during the first 0.4 seconds?

(A) 25 m/s^2 (B) 9.8 m/s^2 (C) 50 m/s^2 (D) 12 m/s^2

$V_o : 0$ $d = 96cm$ $t = 0.4s$ $a = ?$ $d = V_o t + \frac{1}{2}at^2$ $a = \frac{2d}{t^2}$ $a = \frac{2(96cm)(\frac{1m}{100cm})}{(0.4s)^2} = 12 m/s^2$ .16

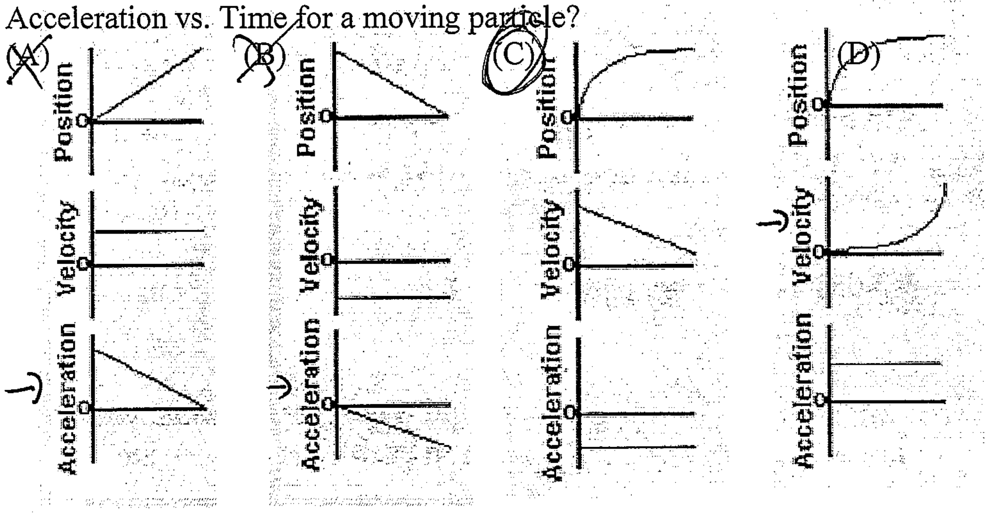
19. What was the instantaneous velocity of the cart at 96 centimeters from the start?

(A) 0.6 m/s (B) 4.8 m/s (C) 1.9 m/s (D) 60 m/s (E) 2.4 m/s

$V_f = V_o + at$

$V_f : (12 m/s^2)(0.4s) = 4.8 m/s$

19. Which of the following sets of graphs might be the corresponding graphs of Position, Velocity, and Acceleration vs. Time for a moving particle?

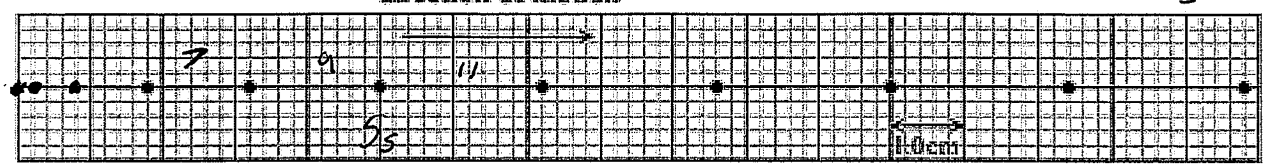


3.

A car moves along a straight road. At time $t = 0$ the car starts to move from rest and oil begins to drip from the engine of the car. One drop of oil is produced every 0.80 s. Oil drops are left on the road. The position of the oil drops are drawn to scale on the grid below such that 1.0 cm represents 4.0 m. The grid starts at time $t = 0$.

$\frac{X\,m}{4\,m} = \frac{2\,boxes}{5\,boxes}$ $X = \frac{2}{5} \cdot 4 = 1.6\,m$

direction of motion



(a) (i) State the feature of the diagram above which indicates that, initially, the car is accelerating. [1]

Dots ~~are~~ start close and slowly spread out.

(ii) On the grid above, draw further dots to show where oil would have dripped if the drops had been produced from the time when the car had started to move. [2]

(iii) Determine the distance moved by the car during the first 5.6 s of its motion. [1]

~~5s 4m 20m~~

$a = 1.6\,m/s$, $v_0 = 0$, $d = ?$, $t = 5.6\,s$

$d = v_0 t + \frac{1}{2} a t^2$

$d = \frac{1}{2} a t^2$

$= \frac{1}{2}(1.6\,m/s)(5.6)^2$

$= 25.1\,m$

(b) Using information from the grid above, determine for the car,

(i) the final constant speed. [2]

$\frac{12\,squares}{1\,s}\left(\frac{4\,m}{5\,squares}\right) = 9.6\,m/s$

(ii) the initial acceleration. [2]

increases by $\frac{2\,squares/s}{1\,second}\left(\frac{4\,m}{5\,squares}\right) = 1.6\,m/s^2$