**1. If a rock is thrown upward on the planet Mars with a velocity of 10 m/s, its height in  
meters t seconds later is given by 𝑦 = 10𝑡 ― 1.86𝑡2**

**(a) Find the average velocity over the given time intervals:**

To find the average velocity over the given time intervals, we need to calculate the rock's displacement during each interval and divide it by the interval's duration.

*(a) Average velocity over the given time intervals:*

**(i) [1, 2]:**

We can find the average velocity from time t = 1 to t = 2, by subtracting the initial position (t = 1) from the final position (t = 2) and dividing it by the time interval (2 - 1 = 1).

Initial position (t = 1):

y(1) = 10(1) - 1.86(1^2)

= 10 - 1.86

= 8.14 m

Final position (t = 2):

y(2) = 10(2) - 1.86(2^2)

= 20 - 7.44

= 12.56 m

Displacement: y(2) - y(1)

= 12.56 - 8.14

= 4.42 m

Average velocity: Displacement / Time interval

= 4.42 m / 1 s

= 4.42 m/s

**(ii) [1, 1.5]:**

Similarly, for the time interval from t = 1 to t = 1.5:

Initial position (t = 1):

y(1) = 8.14 m (from the previous calculation)

Final position (t = 1.5):

y(1.5) = 10(1.5) - 1.86(1.5^2)

= 15 - 4.185

= 10.815 m

Displacement: y(1.5) - y(1)

= 10.815 - 8.14

= 2.675 m

Average velocity: Displacement / Time interval

= 2.675 m / 0.5 s

= 5.35 m/s

**(iii) [1, 1.1]:**

For the time interval from t = 1 to t = 1.1:

Initial position (t = 1):

y(1) = 8.14 m (from the previous calculation)

Final position (t = 1.1):

y(1.1) = 10(1.1) - 1.86(1.1^2)

= 11 - 2.0466

= 8.7494 m

Displacement: y(1.1) - y(1)

= 8.7494 - 8.14

= 0.6094 m

Average velocity: Displacement / Time interval

= 0.6094 m / 0.1 s

= 6.094 m/s

**(iv) [1, 1.01]:**

For the time interval from t = 1 to t = 1.01:

Initial position (t = 1):

y(1) = 8.14 m (from the previous calculation)

Final position (t = 1.01):

y(1.01) = 10(1.01) - 1.86(1.01^2)

= 10.1 - 1.8666

= 8.2027 m

Displacement: y(1.01) - y(1)

= 8.2027 - 8.14

= 0.0627 m

Average velocity: Displacement / Time interval

= 0.0627 m / 0.01 s

= 6.27 m/s

**(v) [1, 1.001]:**

For the time interval from t = 1 to t = 1.001:

Initial position (t = 1):

y(1) = 8.14 m (from the previous calculation)

Final position (t = 1.001):

y(1.001) = 10(1.001) - 1.86(1.001^2)

= 10.01 - 1.86603

= 8.1463 m

Displacement: y(1.001) - y(1) = 8.1463 - 8.14 = 0.0063 m

Average velocity: Displacement / Time interval = 0.0063 m / 0.001 s = 6.3 m/s

**#Solution-1b):**

**Estimate the instantaneous velocity in Excel when 𝑡 = 1:**

**A screenshot of a graph

AI-generated content may be incorrect.**

**2. The displacement (in centimeters) of a particle moving back and forth along a straight line  
is given by the equation of motion 𝑠 = 2sin(𝜋𝑡) +3cos (𝜋𝑡), where t is measured in  
seconds**

**(a) Find the average velocity during each time period:**

Here, Given:

𝑠 = 2sin (𝜋𝑡) + 3cos (𝜋𝑡)

**(i) [1, 2]**

At t=1,

s (1) = 2 sin (𝜋\*1) + 3 cos (𝜋\*1)

s (1) = 2 sin (𝜋) + 3 cos (𝜋)

s (1) = 2 (0) + 3 (-1)

s (1) = -3 cm

At t=2,

s (2) = 2 sin (𝜋\*2) + 3 cos (𝜋\*2)

s (2) = 2 sin (2𝜋) + 3 cos (2𝜋)

s (2) = 2 (0) + 3 (1)

s (2) = 3 cm

Displacement during the interval is,

Δs = s (2) -s (1)

Δs = 3-(-3)

Δs = 6cm

The time duration of the interval (Δt) is 2-1=1 sec.

So, average velocity= Δs/Δt

= 6/1

=6 cm/s

**(ii) [1, 1.1]**

At t=1,

s (1) = -3 cm

At t=1.1,

s (1.1) = 2 sin (𝜋\*1.1) + 3 cos (𝜋\*1.1)

s (1.1) = 2 sin (1.1𝜋) + 3 cos (1.1𝜋)

s (1.1) = -3.4712 cm

Displacement during the interval is,

Δs = s (1.1) -s (1)

Δs = -3.4712- (-3)

Δs = -0.4712 cm

The time duration of the interval (Δt) is (1.1)-1=0.1 sec.

So, average velocity= Δs/Δt

= -0.4712/0.1

=-4.712 cm/s

**(iii) [1, 1.01]**

At t=1,

s (1) = -3 cm

At t=1.01,

s (1.01) = 2 sin (𝜋\*1.01) + 3 cos (𝜋\*1.01)

s (1.01) = 2 sin (1.01𝜋) + 3 cos (1.01𝜋)

s (1.01) = -3.06134 cm

Displacement during the interval is,

Δs = s (1.01) -s (1)

Δs = -3.06134- (-3)

Δs = -0.06134 cm

The time duration of the interval (Δt) is (1.01)-1=0.01 sec.

So, average velocity= Δs/Δt

= -0.06134/0.01

=-6.134 cm/s

**(iv) [1, 1.001]**

At t=1,

s (1) = -3 cm

At t=1.001,

s (1.001) = 2 sin (𝜋\*1.001) + 3 cos (𝜋\*1.001)

s (1.001) = 2 sin (1.001𝜋) + 3 cos (1.001𝜋)

s (1.001) = -3.006268 cm

Displacement during the interval is,

Δs = s (1.001) -s (1)

Δs = -3.006268- (-3)

Δs = -0.006268 cm

The time duration of the interval (Δt) is (1.001)-1=0.001 sec.

So, average velocity= Δs/Δt

= -0.006268/0.001

=-6.268 m/s

**Solution-2b):**

**A screenshot of a computer

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**3. (a) Estimate the value of  
lim  
𝑥→0  
sin (𝑥)  
sin (𝜋𝑥)**

**by graphing the function 𝑓(𝑥) = sin 𝑥  
( sin 𝜋 𝑥) in Excel. State your answer correct to two  
decimal places**

**🡺**

Here we can see that (0/0) is indeterminate from now we can apply the L’hospital rule.

L=

=

=

= []

= =

= 0.32

**(b) Check your answer in part (a) by evaluating 𝑓(𝑥) for values of x that  
approaches 0 in Excel**

A graph with a line and a point

AI-generated content may be incorrect.

**4.**

1. **Estimate the value of the limit lim  
   𝑥→0  
   (1 + 𝑥)1/𝑥 to five decimal places. Does this  
   number look familiar?**

**🡺**

= [1+1+

=[ + + + ……………]

=e=2.71

Using the binomial expression function, we get:

1. **Illustrate part (a) by graphing the function 𝑦 = (1 + 𝑥)1/𝑥 in Excel**

🡺

A graph with a line going up

AI-generated content may be incorrect.

**5. (a) Graph the function 𝑓(𝑥) = 𝑒𝑥 + ln |𝑥 ― 4| for 0 ≤ x ≤ 5 in Excel. Do you  
think the graph is an accurate representation of f ?**

🡺

A graph with a line

AI-generated content may be incorrect.

By seeing the graph we can say that the graph is undefined at x =4. I took the range from 1 to 5. And I believe that if more smaller value of x are taken, the graph would be more accurate.

**(b) How would you get a graph that represents f better?**

**🡺**

To get a graph that represents the function better, we can specify the domain over

the range of 3.8 ≤ x ≤ 4.15 as shown below.

A graph with a line and numbers

AI-generated content may be incorrect.

**A math problem with black text

AI-generated content may be incorrect.**

**🡺solution:**

⇒

⇒

⇒

⇒

⇒

⇒

⇒3\*2

⇒6

⇒

⇒6

1. **How close to 1 does x have to be to ensure that the function in part (a) is within  
   a distance 0.5 of its limit?**

**A graph with a line and numbers

AI-generated content may be incorrect.**From the graph we can see that x has to be approximated of 0.932 to be within distance of 0.5 from the limit.