Unit 1 – Worksheet Answer Key

Worksheet 1.1

1) 5.33x10^5 m
2) a. 0.28 m/s b. 14 m/s c. 22 m/s d. 28 m/s
3) a. 38 m/s b. 47 m/s c. 120 m
4) a. i. 50 m/s^2 ii. -10 m/s^2 iii. 50 m/s^2 b. B, since v = 0 c. Area under curve from A → B: 22m
5) a. d_{total} = 47.4 m → so OK! b. d_{total} = 60.2 m → Mooseburgers!
6) 3 m/s^2
7) 13.3 m/s
8) 69.6 m/s
9) 4.0 m/s^2
10) 2.29 s
11) Yes, after 8 s the passenger is 64 m from station, and train is 62 m. Therefore they meet.
12) a. a = slope = 0.67m/s^2 b. \( y = 0.67x - 5 \) c. 69 m d. 39 m
13) A: 0 m/s^2 B: -2m/s^2 C: 0 m/s^2 D: 2.5 m/s^2 E: -2 m/s^2

Worksheet 1.2

1) Don’t do!

2) a) Plot a straight line graph of \( d \) vs. \( t^2 \). (2 marks)

![Graph of d vs. t^2]

b) From your straight line graph, determine the slope of the line. (Include units.) (1 mark)

\[
\text{slope} = \frac{\Delta d}{\Delta t^2} = 0.28 \text{ m/s}^2
\]

(Allocate one mark for 0.28 m/s^2 only.)

c) What is the acceleration due to gravity on the surface of this asteroid? (2 marks)

\[
\begin{align*}
\frac{r^2}{2} &= \frac{1}{2}a^2 \\
\frac{r^2}{2} &= (0.28 \text{ m/s}^2)^2 \\
\frac{r^2}{2} &= 0.28 \text{ m/s}^2 \\
a &= 0.56 \text{ m/s}^2
\end{align*}
\]

(Allocate one mark for 0.28 m/s^2 only.)

3) Plot the data on the graph below and draw a line of best fit. Extend the line back to the ‘y’ axis so that you have a y-intercept point and determine the slope of the line.

![Graph of F vs. a]

b) Using your slope value and your y-intercept value from the graph, determine the coefficient of friction between the block and the floor.

\[
F - F_g = ma \\
F = ma + F_g
\]

\( y \)-intercept = \( F_g = 17.5 \) N

slope = \( max = 9.1 \text{ kg} \)

\( 17.5 = \mu mg \)

\( 17.5 = \mu (9.1) 9.1 \) N

\( \mu = 0.20 \) ← 1 mark

(1 mark)
5. (5 marks)

A student measures the final speed of an accelerating car at various displacements. The data obtained is shown below.

<table>
<thead>
<tr>
<th>FINAL SPEED (m/s)</th>
<th>$v^2$ (m²/s²)</th>
<th>DISPLACEMENT (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.9</td>
<td>44.8</td>
<td>2.0</td>
</tr>
<tr>
<td>6.7</td>
<td>42.4</td>
<td>4.0</td>
</tr>
<tr>
<td>7.2</td>
<td>51.8</td>
<td>6.0</td>
</tr>
<tr>
<td>7.9</td>
<td>62.4</td>
<td>8.0</td>
</tr>
<tr>
<td>8.4</td>
<td>76.6</td>
<td>10.0</td>
</tr>
<tr>
<td>9.9</td>
<td>81.0</td>
<td>12.0</td>
</tr>
</tbody>
</table>

For a graph of the final speed squared, $v^2$, versus the displacement, $d$, of the car on the graph below.

Determine the slope of the line of best fit to the data and state what the slope represents. Extend the line to the y-axis and use the y-intercept to determine the initial speed of the car.

Slope calculation:

$$m = \frac{\Delta v^2}{\Delta d}$$

$$= \frac{81 - 42}{12 - 4}$$

$$= \frac{4.9}{2}$$

Slope = $2 \times$ acceleration of the car ← 2 marks

y-intercept $= 24$ m²/s²

$\therefore v_0 = \sqrt{24} = 4.9$ m/s ← 1 mark

Worksheet 1.3

1) 0.39 2) 0.42 3) 0.90 4) 13° 5) 74° 6) 27°

1) $x = 63; \ y = 30.2 \ x = 14; \ y = 39 \ 3) \ R = 7.6; \ \theta = 23^\circ \ 4) \ R = 56; \ \theta = 53^\circ \ 5) \ \theta_1 = 4.47; \ R_x = 3.16 \ 6) \ \text{Resultant} = 10.0$

1) $R_x = 1.7 \ \text{cm}; \ R_y = 9.8 \ \text{cm} \ 2) \ R_x = 3.4 \ \text{cm}; \ R_y = 9.4 \ \text{cm} \ 3) \ R_x = 5.0 \ \text{cm}; \ R_y = 8.7 \ \text{cm} \ 4) \ R_x = 7.1 \ \text{cm}; \ R_y = 7.1 \ \text{cm} \ 5) \ \text{Resultant} = 10.0$

Worksheet 1.3

1) A → B → C

2) $Ax = 5.17 \ \text{cm}; \ Ay = 1.88 \ \text{cm}; \ Bx = -1.69 \ \text{cm}; \ By = 0.62 \ \text{cm}; \ Cx = 1.05 \ \text{cm}; \ C\uparrow$

3) 4.53 cm 4) 0.24 cm 5) $R$

6) $R = 4.54 \ \text{cm} \ \theta = 3.0^\circ$
Draw and Add Vectors

1) 11.3 m 22° E of N  
2) 188 m/s 23° W of S  
3) 9.4 m 29° E of S  
4) 72 m/s 78° E of S

Change in Quantity

1) 10 m/s² 53° E of S  
2) 15 m/s² 68° E of S  
3) 9.8 m/s² down  
4) 367 m/s² back  
5) Don’t Do!  
6) 9.7 m/s² 30° S of E

Worksheet 1.4

1) a. 2.7 m/s 33°  
b. 33°  
c. 21.6 m  
d. 41°

Vector Problems

1) 148 m  
3) 67°  
5) 23.6°

7) swimmer 5: 494 s, ends up 693 m downstream, swimmer 6: 545 s

9) 587 km E and 749 km N

Vector Problems (Cosine or Trigonometric Methods)

1) 9.5 km/h 30° E of N

3) 271 km/h 11° W of N; 2.1 h

5) 288 km/h 8° E of N

Worksheet 1.5

1) Vx = 36.8 m/s; Vyo = 30.8 m/s

3) a. Vx = 30.8 m/s; Vyo = 36.8 m/s  
b. 7.50 s  
c. 231 m  
d. 30.8 m/s horizontal

5) a. 10.0 s  
b. 279 m  
c. Oh Yeah!

7) a. Vx = 20.8 m/s; Vyo = 12 m/s  
b. 2.45 s  
c. 50.9 m  
d. 7.34 m  
e. 24 m/s 30° below horiz

9) 11 m High

11) 1.28 s

13) 24.7 m/s 53° above horiz