Answers to Example Problems - Chapter 1

EX A.) 3 kg

EX B.) m

EX C.) varies, depending on the experiment

EX D.) $d = (4.9\ m/sec^2)t^2$

EX E.) $v = 3d^2 + 6$

EX F.) $q = 9/t + 3$

Answers to Example Problems - Chapter 2

EX G.) $x = 4.6$
$y = 3.86$

EX H.) $h = 5$
$y = 4.7$

EX I.) $\alpha = 27^\circ$
$y = 4.1$

EX J.) $\sin\beta = a/h$
$\cos\alpha = a/h$
$\cos\alpha = \sin\beta$
$\cos\alpha = \sin(90^\circ-\alpha)$

EX K.) $a^2 + b^2 = c^2$
$a^2/c^2 + b^2/c^2 = c^2/c^2$
$\sin^2\alpha + \cos^2\alpha = 1$

EX L.) $L_x = -4$
$L_y = -5.7$

EX M.) typical sine and cosine graphs.

Answers to Example Problems - Chapter 3

EX N.) 18 kg.m/sec @ 30°

EX O.) 16 units @ 40°

EX P.) 4 units @ 60°

EX Q.) $R^2 = A^2 + B^2 = 36$ units
$\arctan\theta = 30/20 = 56°$

EX R.) $A_x = A\cos\theta = 17.3$ units
$A_y = A\sin\theta = 10$ units

EX S.) $A_x = A\cos\theta = 17.3$
$A_y = A\sin\theta = 10$

$B_x = B\cos\alpha = 12$
$B_y = B\sin\alpha = 32.9$

$R_x = A_x + B_x = 29.3$
$R_y = A_y + B_y = 42.9$

$R^2 = R_x^2 + R_y^2 = 51.9$
$\arctan\theta = 42.9/29.3 = 56°$

EX T.) $R_x = R\cos\theta = 29.6$
$R_y = R\sin\theta = 63.4$

$A_x = A\cos\alpha = -52$
$A_y = A\sin\alpha = 30$

$B_x = R_x - A_x = -22.4$
$B_y = R_y - A_y = 93.4$

$R = 96$ @ 103°

EX U.) $R_x = R\cos\theta = 1.0$
$R_y = R\sin\theta = 3.86$

$A_x = A\cos\alpha = 16$
$A_y = A\sin\alpha = -5.8$

$B_x = R_x - A_x = -15$
$B_y = R_y - A_y = 9.67$

$R = 17.8$ @ 147°

<u>Answers to Example Problems - Chapter 4</u>

EX V.) $v = \Delta d/\Delta t = 2/3$ m/s

EX W.)
a.) B
b.) C
c.) A
d.) C
e.) different starting positions
f.) going in reverse
g.) same place at the same time
h.) different starting times

EX X.)
a.) moving foreward at 1 m/s
b.) standing still
c.) moving backwards at 4 m/s

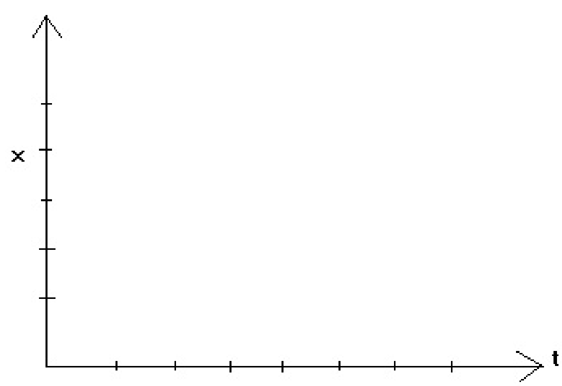
EX Y.) going foreward, speeding up as it goes

EX Y.) answers may vary, but should be around $v_3 = 2/3$ m/s and $v_5 = 3$ m/s

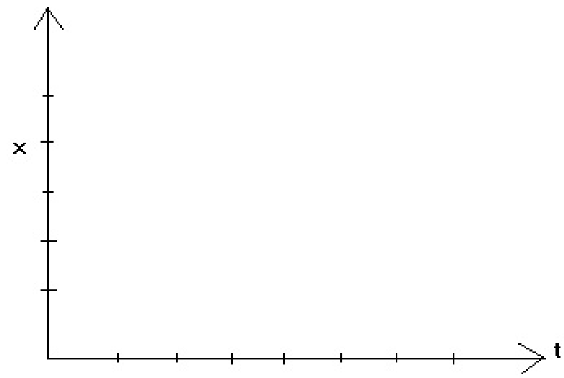
EX Z.)
a.) a,d
b.) b-c
c.) a-b
d.) c-d

EX AA.)
a.) A-B, D-E
c.) C, F-G
d.) C-D, G-H
e.) B-C, E-F
f.) A-C, G-H
g.) C-F

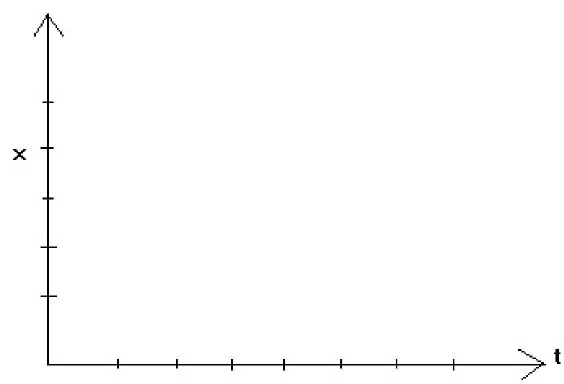
EX AB.)



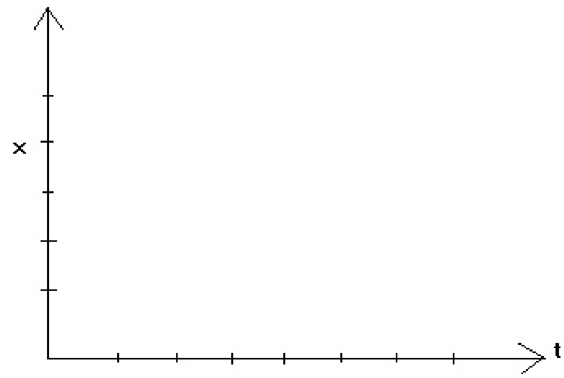
EX AC.)

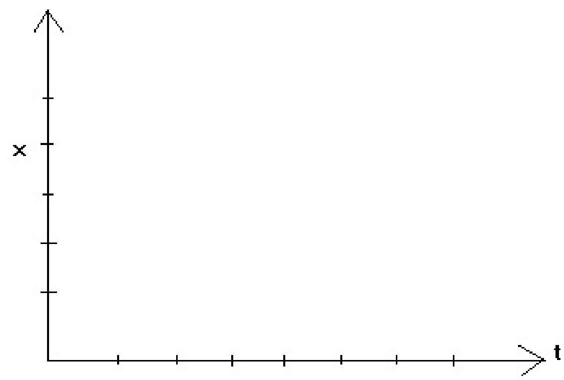


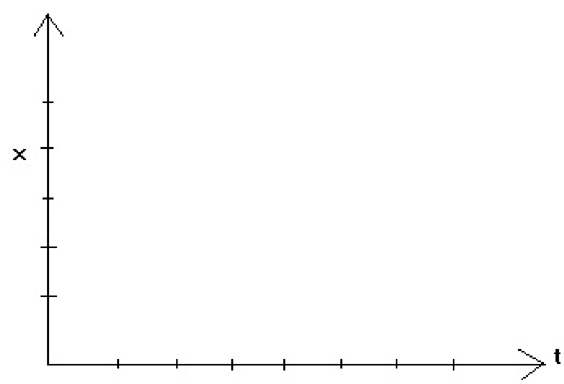
EX AD.)



EX AE.)







EX AF.) approximately 35.75 m

Answers to Example Problems - Chapter 5

EX AG.) $v = 3$ m/s North

EX AH.) $v_{new}^2 = v_{bw}^2 + v_{ws}^2$

$v_{bs} = 18.4$ m/s

$\arctan(9/16) = \theta = 29.4°$ South of West

EX AI.) R = Plane + Wind

$P_x = 193$ mi/hr

$P_y = 51.8$ mi/hr

$W_x = 17.5$ mi/hr

$W_y = 30$ mi/hr

$R_x = P_x + W_x = 211$ mi/hr

$R_y = P_y + W_y = 82$ mi/hr

$R = (51128)^{1/2} = 226$ mi/hr

$\theta = \arctan(82/210) = 21.3°$

EX AJ.) $v_{vg} = 60$ km/hr @ 270°

$v_{tg} = 100$ km/hr @ 0°

$v_{vt} = v_{vg} + v_{gt}$ (note: must reverse v_{tg})

$v_{vt} = (60^2 + 100^2)^{1/2} = 116.6$ km/hr

$\theta = 211°$ or 31° S of W

Answers to Example Problems - Chapter 6

EX AK.)	0	8 m/s^2
	8 m/s	8 m/s^2
	16 m/s	8 m/s^2
	24 m/s	8 m/s^2
	32 m/s	8 m/s^2
	40 m/s	8 m/s^2
	48 m/s	8 m/s^2

EX AL.)	0	-8 m/s^2
	-8 m/s	-8 m/s^2
	-16 m/s	-8 m/s^2
	-24 m/s	-8 m/s^2
	-32 m/s	-8 m/s^2
	-40 m/s	-8 m/s^2
	-48 m/s	-8 m/s^2

EX AM.)	90 m/s	-8 m/s^2
	82 m/s	-8 m/s^2
	76 m/s	-8 m/s^2
	68 m/s	-8 m/s^2
	60 m/s	-8 m/s^2
	52 m/s	-8 m/s^2
	44 m/s	-8 m/s^2

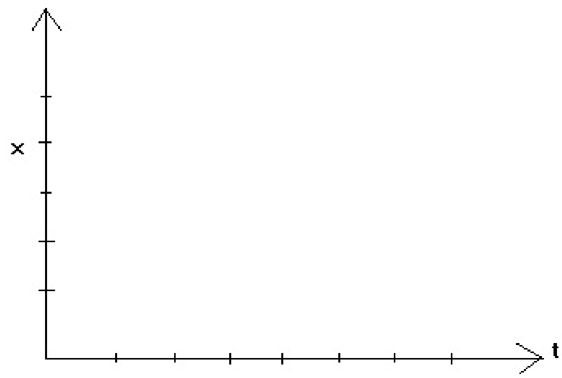
EX AN.)	-90 m/s	8 m/s^2
	-82 m/s	8 m/s^2
	-76 m/s	8 m/s^2
	-68 m/s	8 m/s^2
	-60 m/s	8 m/s^2
	-52 m/s	8 m/s^2
	-44 m/s	8 m/s^2

EX AO.)
- a.) A-B, D-E, F-G
- b.) B-D, E-F, G-H
- c.) C, F-G
- d.) E-F, G-H
- e.) B-D
- f.) A-C, G-H
- g.) C-F
- h.) C-D, G-H
- i.) B-C, E-F

EX AP.) Going in reverse and speeding up (-v, -a)

EX AQ.) Speeding up from a stop, slowing down and stopping, immediately going at a high speed in reverse.

EX AR.)



EX AS.) $V_f = v_i + at$

EX AT.) $\Delta x/\Delta t = (v_f + v_i)/2$

$\Delta x/\Delta t = (v_i + at + v_i)/2$

$\Delta x/\Delta t = v_i + at/2$

$\Delta x = v_i t + at^2/2$

EX AU.) a.) $v_f = v_i + at$
$v_f = 14$ m/s

b.) $\Delta x = at^2/2$
$\Delta x = 49$ m

EX AV.) a.) 22.2 m/s
$v_f^2 = v_i^2 + 2a\Delta x$

$a = -30.8\ m/s^2$

b.) $v_f = v_i + at$
$t = 0.72$ sec

EX AW.) a.) $x_f = (1.5\ )t^2$ $x_f - 100 = (-1)t^2$
isolate t
$x_f = 60$ m

b.) 6.3 sec

EX AX.) $v_x = 28.3$ m/s
$v_y = 28.3$ m/s

at = 40 m/s at 25° W of N

$at_x = -16.9$ m/s
$at_y = 36.3$ m/s

$v_f = v_i + at$

$v_{fx} = 11.4$ m/s
$v_{fy} = 64.6$ m/s

$v_f = 65.6$ m/s at 80° N of E

EX SY.) approximately 4 m/sec^2

Answers to Example Problems - Chapter 7

EX AZ.)

$\Delta x = v_i t + (0.5)at^2$

$(12\text{ m}) = (20\text{ m/s})t + (-4.9\text{ m/s}^2)t^2$

$t = 0.73$ sec (or 3.3 sec)

$v_f = v_i + at$

$v_f = 12.8$ m/sec

EX BA.)

a.) $v_f^2 = v_i^2 + 2a\Delta x$

$\Delta x = 81.6$

b.) $v_f = 40$ m/s or -40 m/s

EX BB.)

$50\text{ m} = 40t - 4.9t^2$

$t = 1.5$ sec or 6.6 sec

EX BC.)

$20\text{ m} = 0 + 4.9t^2$

$t = 2.02$ s

$22\text{ m} = 4.9t^2$

$t = 2.12$ s

$\Delta t = 0.1$ sec

Answers to Example Problems - Chapter 8

EX BE.)

$\Delta y = v_y t + (.5)at^2$
$-100\ m = (-4.9)t^2$
$20.4\ sec^2 = t^2$
$t = 4.52\ sec$

$\Delta x = (70\ m/s)t$
$\Delta x = 316\ m$

EX BF.)

$\Delta y = v_y t + (.5)at^2$
$-100\ m = (35\ m/s)t - (4.9\ m/s^2)t^2$
$t = 9.3\ sec\ or\ -2.1\ sec$

$\Delta x = v\cos\theta t$
$\Delta x = 566\ m$

EX BG.)

$v_x = 38.75\ m/s$
$v_y = 46\ m/s$

$\Delta x = v_x t$
$t = 5.2\ sec$

$\Delta y = v_y t + (.5)at^2$
$\Delta y = (46\ m/s)(5.2\ sec) + (-4.9\ m/s^2)(5.2\ s)^2$
$\Delta y = 106.4\ m$
yes, it clears the cliff

EX BH.)

$\Delta x = v_x t$
$t = x/v_x$

$\Delta y = v_y t + (.5)at^2$
$y = (v_y/v_x)x + (.5)g(x/v_x)^2$
$y = (v\sin\theta/v\cos\theta)x + (.5)g(x^2/v_x^2)$
$y = (\tan\theta)x + (.5)gx^2(v^2\cos^2\theta)$

EX BI.)

max range means greatest Δx, this occurs when:
$v_i^2\sin 2\theta/g$ is a maximum
This occurs when $\sin 2\theta$ is max
$\sin 2\theta = 1$ when $2\theta = 90°$

$\theta = 45°$

EX BJ.) $v_x = 53.6$ m/s

$v_y = 45$ m/s

v_x remains the same

$v_{fy}^2 = v_{iy}^2 + 2a\Delta y$

$v_{fy}^2 = (45 \text{ m/s})^2 + 2(-9.8 \text{ m/s}^2)(-50 \text{ m})$

$v_{fy} = 54.8$ m/s

$v^2 = v_x^2 + v_y^2$

$v = 76.6$ m/s

$\arctan(54.8/53.6) = \theta$

$\theta = 45.6°$

Answers to Example Problems - Chapter 9

EX BK.)

$\omega_f = \omega_i + \alpha t$
$0 = (6\ rad/s) + (-0.3\ rad/s^2)t$
$t = 20\ sec$

EX BL.)

$4\ rev = 8\pi\ rad = 25.1\ rad$

$\Delta\theta = \omega_i t + (.5)\alpha t^2$
$25.1\ rad = (.5)(3\ rad/s^2)t^2$
$t = 4.1\ sec$

EX BM.)

$45\ rev = 282.7\ rad$
$\Delta\theta = w_i t + (.5)\alpha t^2$
$282.7\ rad = (25\ rad/s)t + (.5)(2\ rad/s^2)t^2$
$t = (-25 \mp 42)/2$
$t = 8.45\ sec$

EX BN.)

$C = 2\pi r = 9.42 \times 10^{11}\ m$
$1\ year = 3.15 \times 10^7\ sec$

$v = d/t = 2.99 \times 10^4\ m/s$

EX BO.)

$\alpha = a/r$
$\alpha = 0.4\ rad/s^2$

$\Delta\theta = \omega_i t + (.5)\alpha t^2$
$\Delta\theta = (0.2\ rad/s^2)(15\ sec)^2$
$\Delta\theta = 45\ rad$

EX BP.)

$\omega = 3.5\ rad/s$
$v_t = \omega r$

$v_{t4} = 0.14\ m/s$
$v_{t10} = 0.35\ m/s$
$v_{t20} = 0.7\ m/s$

Answers to Example Problems - Chapter 10

Ex BQ.) $T = (1/2)mv^2 = 22500\ kg.m^2/s^2$

EX BR.) $\Delta U = -mgh$
-1470 J
-1084 ft.lbs
-9.19×10^{21} eV
-1.47×10^{10} ergs

EX BS.) $\Delta U = -mgh = -mghsin\theta$
$= 735$ J

EX BT.) $\Delta H = mc\Delta T = (.1\ kg)(4190\ J/kg.^{\circ}C)(50^{\circ}\ C)$
$= 20950$ J

EX BU.) $H_1 = mc\Delta T = 2497.5$ J
$H_2 = mh_f = 25050$ J
$H_3 = mc\Delta T = 23568$ J

$H_{total} = 51116$ J

EX BV.) As the ball rolls down, PE is changed to KE, thus increasing the speed. On the flat area, KE changes to heat through friction, thus reducing the speed.

EX BW.) As the car rolls down, PE changes to KE. When it hits the pole, the KE changes to heat, sound and mechanical PE (in the collision). When the engine is turned on, chemical energy is converted to kinetic energy.

EX BX.) When the brakes are applied, the KE of the car is converted to heat in the brakes and the road.

EX BY.) When the planet is close to the sun, it has a high speed (KE) and lower radius (GPE). As it moves further out, the GPE increase, and the KE decreases to make up for it.

EX BZ.) When the rocket takes off, chemical PE is changed to heat, sound and some KE. As it climbes, the KE and the PE increases, and the chemical PE continues to decrease.

EX CA.) Ah, a tough one. As the balloon rises, its KE and GPE both increase. This increase is made possible because the heavier air it displaces moves down thus decreasing its own GPE. The lost GPE of the air contributes to the gain of PE and KE of the balloon.

EX CB.) As they fall, their PE decreases and their KE increases. With air resistance, there is also an increase of heat, with continues to increase until all the loss of PE is going to heat and none of it is left to go to KE. At terminal velocity, as fast as PE is lost, heat is gained.

EX CC.) at point B: $v = 6.26$ m/s
at point C: $v = 4.43$ m/s

EX CD.) $\Delta H = mc\Delta T = (1/2)mv^2 = (1/2)(1500 \text{ kg})(25 \text{ m/s})^2$
$\Delta T = 174^\circ$ C

EX CE.) at hill B: $v = 2$ m/s
at hill C: $v = 20$ m/s
at hill D: $v = 28.1$ m/s

EX CF.) $E_i = 2000$ J
$E_f = 781.25$ J
$\Delta E = 1219$ J
$v_{fc} = 19.7$ m/s

EX CG.) a.) $\Delta x = (2mgh/k)^{1/2} = 0.18$ m
b.) use $T_i = T_f + \Delta U$
$0 = (1/2)mv^2 - (1/2)kx^2(\text{eff})$
$v = 3.83$ m/s
c.) $\Delta h = 1.5$ m

EX CH.) Energy = 7840 J
$P = E/t = 2614$ W

EX CI.) 100 mph = 44.7 m/s
2000 ft = 609.6 m
$\Delta E = mgh + (1/2)mv^2$
$\Delta E = 11{,}900{,}000 \text{ J} + 2{,}000{,}000 \text{ J}$
$\Delta E = 1.39 \times 10^7$ J

$P = E/t = 115{,}833$ W.