PRACTICE MIDTERM

1) (3) $m = 1200\,kg$, $v = 15\,m/s$, $p = ?$ $\quad p = mv = (1200)(15) = 1.8 \times 10^4\ kg\,m/s$, east.

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2) (3) $F_g = \frac{G m_1 m_2}{r^2} \Rightarrow F_g \propto \frac{1}{r^2}$ - inverse squared LL

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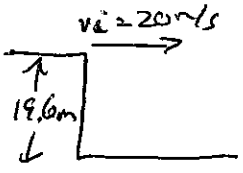
3) (2)



x	y
$v_i = 20$	$v_i = 0$
$a = 0$	$a = 9.8$
	$d = 19.6$
	$t = ?$

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

$19.6 = 0t + \frac{1}{2}(9.8)t^2$

$19.6 = 4.9t^2$

$4 = t^2$

$\boxed{t = 2s}$

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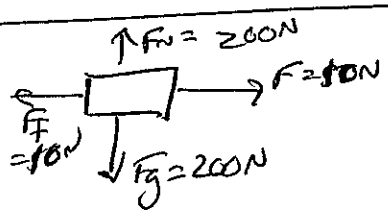
4) (2)



$F_f = F$ (since constant speed, forces cancel)

$F_f = \mu F_N$

$100 = \mu(200)$

$\boxed{\mu = .05}$

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5) (1) 90° will fire it to greatest height. (45°, greatest distance)

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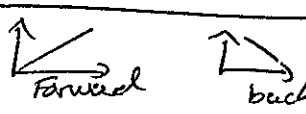
6) (2) constant speed = straight line



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7) (1) $F_f = \mu F_N$ - independent of surface area

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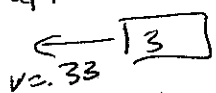
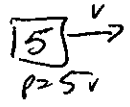
8) (2) Before $p_{tot} = 0$ (at rest)

after



$p = mv = 3(.33) = -.99$



$p_{tot} = -.99 + 5v$

$-.99 + 5v = 0$

$5v = .99$

$v = .198\ m/s$

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9) (2) $F_g = \frac{G m_1 m_2}{r^2}$, $F_g \propto \frac{1}{r^2} \Rightarrow \frac{1}{3^2} = \boxed{\frac{1}{9}}$

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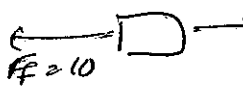
10) (2) Since constant speed, forces cancel



11. (4) $a_g = 9.8 m/s^2$ for any mass.

12. (2) $F_{net} = ma$
$10 = 4a$
$a = 2.5 m/s^2$

13. (3) Time in the air will depend on how far the mass falls.

14. (3) Distance = area $= \frac{b \cdot h}{2} = \frac{(3)(2)}{2} = 3m$

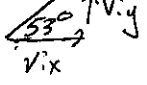
15. (1) $F = ma$
$1 = m(9.8)$
$\boxed{m = .1kg}$

16. (2) $P = \frac{W}{t} = \frac{6000}{30} = 200$ watts.

17. (2) $F_{net} = 0$ means constant speed.

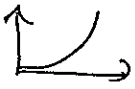
18. (2) $v_i = 0$
$v_f = ?$
$a = 9.8$
$d = 4.9$

~~$v_f = v_i + at$~~
$v_f^2 = v_i^2 + 2ad$
$v_f^2 = 0^2 + 2(9.8)(4.9)$
$v_f^2 = 96.04$
$\boxed{v_f = 9.8}$

19. (2) 

$v_{iy} = 25 \sin 53 = \boxed{20 m/s}$

20. (4) $F\Delta t = m\Delta v$
$15\Delta t = 20(3)$
$\boxed{\Delta t = 4s}$

21. (4) $PE_s = \frac{1}{2}kx^2$
$PE \propto x^2$ – quadratic 

22. (2) $PE = mgh$ – depends on height.

23. (2) $KE = \frac{1}{2}mv^2$
$= \frac{1}{2}(60)(3)^2$
$= 270J$

24 (1) $p = mv$ – if v doubles, p doubles

25. (4) $a_c = \frac{v^2}{r}$ $a_c \propto v^2 \Rightarrow 2^2 = 4x$.

26. (4) At top $PE = mgh = (5)(9.8)(10) = 490\,J$
It must have had 490J of KE @ the bottom.

27. (1) $F_g = \frac{Gm_1m_2}{r^2} = \frac{(6.67\times10^{-11})(1.67\times10^{-27})(9.11\times10^{-31})}{(1\times10^{-10})^2} = 1\times10^{-47}\,N.$

28. (1) Memorize vector list!

29. (4) $F = 1900N$, $m = 1\times10^3$, $d = 2\times10^3$, $W = ?$
$W = Fd = (1900)(2000) = 3{,}800{,}000$

30. (1) Memorize vector list!

31. (4) $F = Kx$
$20 = K(.4)$
$K = \frac{20}{.4} = \boxed{50\,N/m}$

32. (2) $\bar{v} = \frac{d}{t} = \frac{8}{4} = 2\,m/s$

33. (4)


34. (1) $\bar{v} = \frac{d}{t} = \frac{60}{4} = 15\,km/hr$

35. (2) before: $p = 0$ (cart rest)
after: $v = ?$, 80, $p = 80v$
60 → $v = 10$, $p = 60(10) = 600$
$P_{tot} = 80v + 600$
$0 = 80v + 600$
$-600 = 80v$
$\boxed{v = 7.5\,m/s}$

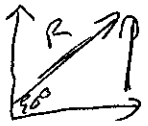
36. (3) 15N - equal and opposite.

37. (3) $v_i = 10\,m/s$, $a = 5\,m/s^2$, $t = 10s$, $d = ?$
$d = v_it + \frac{1}{2}at^2$
$d = 10(10) + \frac{1}{2}(5)(10)^2$
$= 100 + 250 = \boxed{350m}$

38. (4) $a = \frac{v^2}{r} = \frac{20^2}{10} = 40\,m/s^2 \Rightarrow F = ma$
$F = (100)(40)$
$= 4000N$

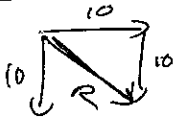
39. (1) mass = inertia

40. (1)



R gets smaller as θ gets bigger.

41. (3)



$R^2 = 10^2 + 10^2$

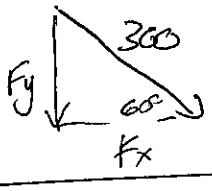
$R^2 = 200$

$R = 14.1\ N$

42. (3) They land at the same time. Time depends on how far they fall, independent of how they are moving horizontally.

43. (2) F_c is always toward center.

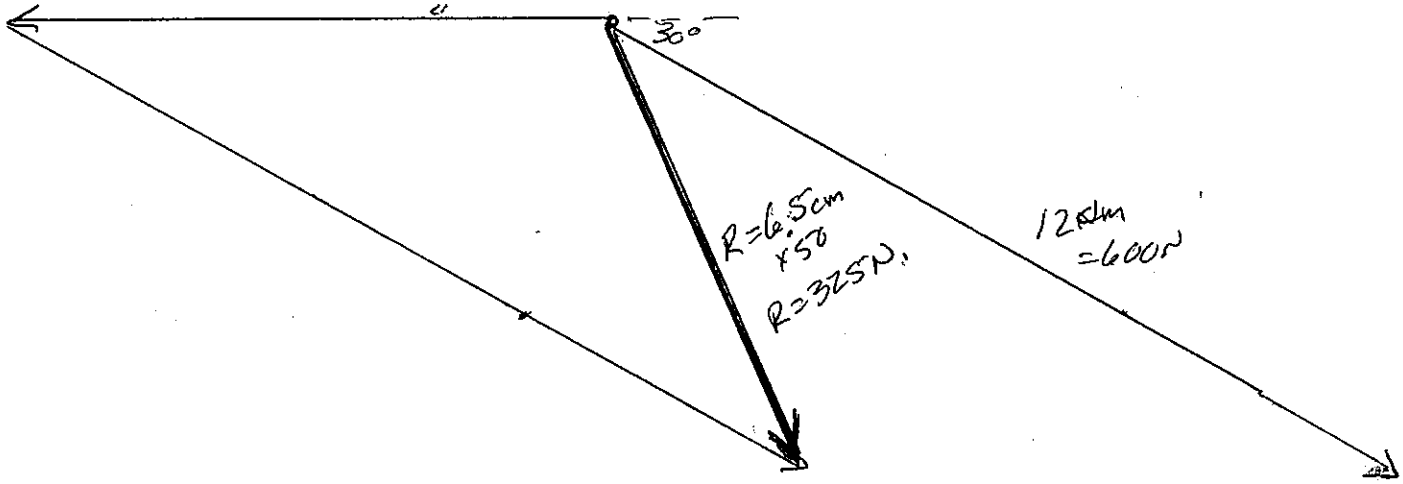
44. (2)



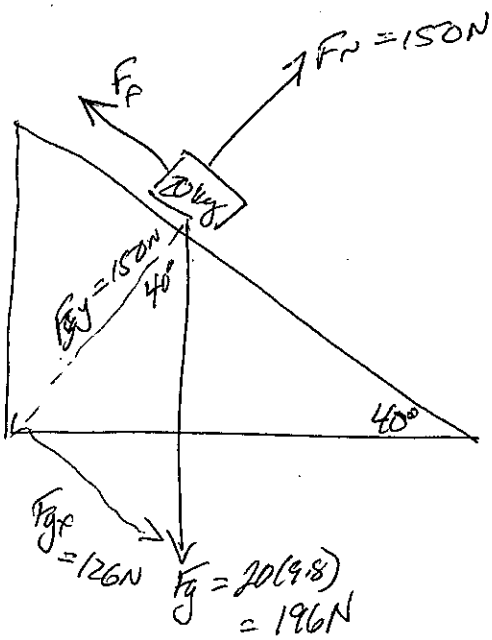
$F_y = 300 \sin 60$

$= 260\ N$

(1)



(2)



$F_{gx} = 196 \sin 40 = 126N$

$F_{gy} = 196 \cos 40 = 150N$

$F_{net} = ma$

$126 - F_f = 20(2)$

$126 - F_f = 40$

$\boxed{F_f = 86N}$

$F_f = \mu F_N$

$86 = \mu(150)$

$\boxed{\mu = .57}$

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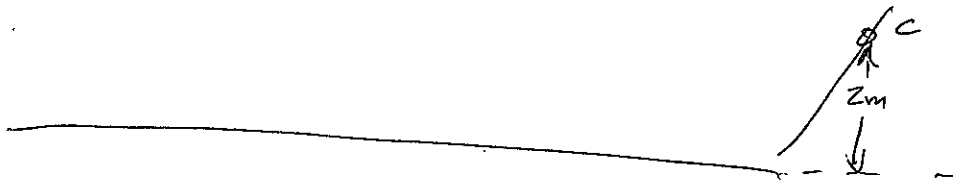
(3)



$PE = mgh = (20)(9.8)(2) = 392J$

	A	B	C
PE	0	0	392 J
KE	0	392	0
PE_S	392	0	0
TOT	392	392	392

a) $KE = \frac{1}{2}mv^2$

$392 = \frac{1}{2}(20)v^2$

$39.2 = v^2$

$\boxed{6.26 \frac{m}{s} = v}$

b) $PE_S = \frac{1}{2}kx^2$

$392 = \frac{1}{2}k(0.5)^2$

$\boxed{3136 \frac{N}{m} = k}$