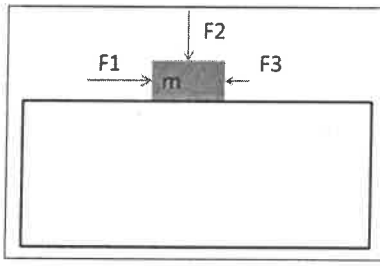
Physics 1005 (SP2020) Exam#1, Name Answers **, ID#**_____**, Score**____

1. **(1D Vertical motion with $a = \pm g$, $g = 10\ m/s^2$, 20%)** A 2-m height person throws a stone vertically to the sky with an initial speed of **10 m/s**. (a) how long it takes to reach the maximum height? **Ans.** 1 s; (b) find the maximum height it can reach **from ground**? **Ans.** 7 m; (c) How long does it take for the stone to return to the ground from the top? **Ans.** 1.2 s; (d) the stone speed just before reaching to the ground? **Ans.** 12 m/s

2. **(2D kinematics, 30%)** As shown in Fig. 1, an object is launched from the ground with a speed of 40 m/s in an angle of 60 degree from horizontal and lands on ground. **Use $g = 10\ m/s^2$ for this problem.**
   (a) What is horizontal initial-launching speed? **Ans.** 20 m/s
   (b) What is the vertical initial-launching speed? **Ans.** $20\sqrt{3}$ m/s ~ 34.6 m/s
   (c) How long does the object take to reach to the maximum height? **Ans.** $2\sqrt{3}$ s ~ 3.5 s
   (d) What is the maximum height the object can reach **above the ground**? **Ans.** 60 m
   (e) How long does it take for the object to reach the ground **after reaching the maximum height**? **Ans.** $2\sqrt{3}$ s
   (f) How far does the object fly horizontally? **Ans.** ~ 139 m

3. **(Dynamics of motion, net-force, 25%)** A mass block is initially at rest on a frictionless solid table top and three forces (F1, F2, & F3) are being applied as indicated at t = 0.



Given F1 = 200 N, F2 = 20 N, F3 = 100 N, and m = 20 kg.
Find:
   a) Gravitational force on the block, Ans. 200 N
   b) Normal force on the block, Ans. 220 N
   c) Net force on the block, Ans. 100 N
   d) Acceleration of block at t = 0, Ans. 5 m/s^2
   e) Indicate the direction of acceleration on the diagram. → along F_1

4. **(Energetics, 25%)** Refer to the problem #3, at time t = 2 second, the block is being displaced to a new location, Δx away from the initial location. Find: **a)** The work done by the net force, Ans. 1000 J; **b)** Kinetics energy of the block at 2 second, Ans. 1,000 J

Fig. 1

Reference equations:

Kinematics (a = 0)	$x = x_0 + v_0 t$		
Kinematics ($a \neq 0$)	$v = v_0 + at$	$x = x_0 + v_0 t + (1/2)at^2$	$v^2 = v_0^2 + 2a(x - x_0)$
Dynamics and Energetics	$F = ma$	$W_F = F \Delta x$	$E_k = (1/2)\, m v^2$
Note:	sin(60°) = cos(30°) = sqrt(3)/2	cos(60°) = sin(30°) = 1/2	