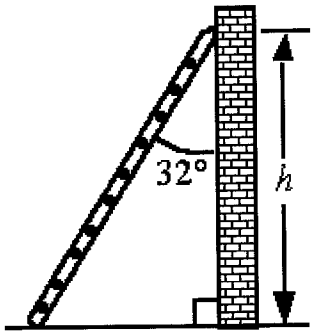
Phys 132 - Fundamentals of Physics 2 **Name:** Solutions
Homework 2 **Due Mon, Jan 22, 2007**

Reading Assignment: Read Chapter 18, Sections 18.1 thru 18.7. One of the problems comes from the new material on the electric field.

Print out this homework assignment. Complete each of the following problems and circle the letter of the correct answer. For those problems that involve math, show all your work NEATLY.

1. A 2.5-m ladder leans against a wall and makes an angle with the wall of 32° as shown in the figure. What is the height h above the floor where the ladder makes contact with the wall?



In the figure, h is adjacent to the angle, so

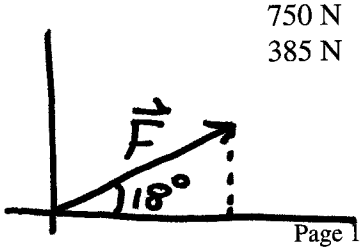
$h = (2.5\text{ m})\cos 32°$

$= 2.1\text{ m}$

A) 2.1 m
B) 1.3 m
C) 2.4 m
D) 1.6 m
E) 1.9 m

2. A force vector has a magnitude of 810 N and points at an angle of 18° above the x-axis. What are the x and y components of this force?

	x component	*y component*
A)	770 N	250 N
B)	560 N	585 N
C)	585 N	560 N
D)	250 N	750 N
E)	713 N	385 N



$F_x = F\cos\theta$

$= (810\text{ N})\cos 18°$

$= 770\text{ N}$

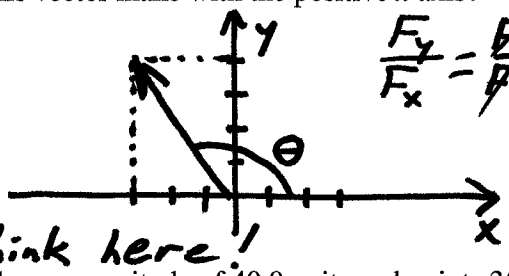
$F_y = F\sin\theta$

$= (810\text{ N})\sin 18°$

$= 250\text{ N}$

3. The x and y components of a force vector are −3.00 N and +4.00 N, respectively. What angle does this vector make with the positive x axis?

A) 233°
B) 127°
C) −53.0°
D) 53.0°
E) 37.0°



$\frac{F_y}{F_x} = \frac{F\sin\theta}{F\cos\theta} = \tan\theta = \frac{+4.00}{-3.00}$

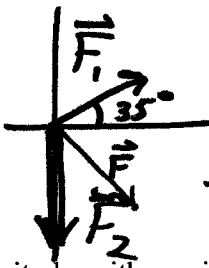
$\theta = \tan^{-1}\left(\frac{-4}{3}\right)$ (maybe $\pm 180°$)

$= -53°$ (maybe $\pm 180°$)

Must think here!

4. A vector $\mathbf{F}_1$ has a magnitude of 40.0 units and points 35.0° above the positive x axis. A second vector $\mathbf{F}_2$ has a magnitude of 65.0 units and points in the negative y direction. Use the component method of vector addition to find the magnitude and direction, relative to the positive x axis, of the resultant $\mathbf{F} = \mathbf{F}_1 + \mathbf{F}_2$.

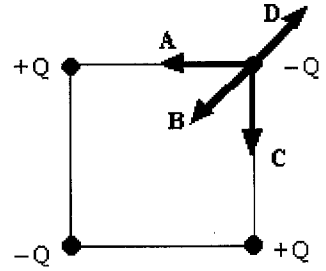
A) 53.3 units, 52.1° below the +x axis
B) 53.3 units, 52.1° above the +x axis
C) 76.3 units, 37.9° below the +x axis
D) 76.3 units, 52.1° above the +x axis
E) 9.23 units, 37.9° below the +x axis

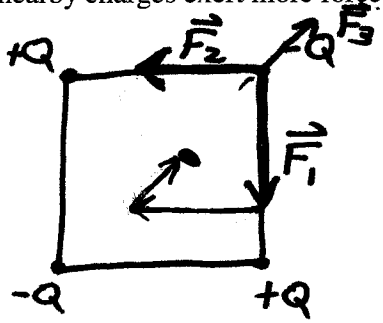


	x	y
F_1	$F_1\cos 35°$	$F_1\sin 35°$
	32.8	22.9
F_2	0	−65
F	32.8	−42.1

$F = \sqrt{32.8^2 + 42.1^2} = 53.3$

5. Four point charges, each of the same magnitude, with varying signs are arranged at the corners of a square as shown. Which of the arrows labeled **A**, **B**, **C**, and **D** gives the correct direction of the net force that acts on the charge at the upper right corner? (Hint: Redraw the figure without the lettered arrows, draw in the correct forces, and add the forces graphically. Remember that nearby charges exert more force than far charges.)





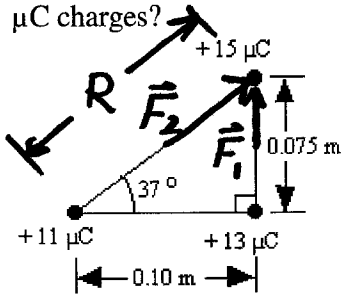
A) A
B) B
C) C
D) D
E) The net force on that charge is zero.

6. A charge Q exerts a 12 N force on another charge q. If the distance between the charges is doubled, what is the magnitude of the force exerted on Q by q?

(A) 3 N
B) 6 N
C) 24 N
D) 36 N
E) 48 N

$F = k\frac{|q_1||q_2|}{r^2}$ ← Double r and F goes down by a factor of 4

7. Three charges are positioned as indicated in the figure. What are the horizontal and vertical components of the net force exerted on the +15 μC charge by the +11 μC and +13 μC charges?



	horizontal	*vertical*
A)	95 N	310 N
B)	76 N	310 N
C)	250 N	130 N
D)	95 N	130 N
(E)	76 N	370 N

$F_1 = k\frac{|q_1||q_2|}{r_1^2} = 8.99\times10^9 \frac{Nm^2}{C^2}\frac{(13\times10^{-6}C)(15\times10^{-6}C)}{(0.075\,m)^2}$

$= 311.7$ N (all in +y direction)

$F_2 = \left(8.99\times10^9 \frac{Nm^2}{C^2}\right)\frac{(11\times10^{-6}C)(15\times10^{-6}C)}{(0.125\,m)^2}$

$F_2 = 94.9$ N (37° above +x)

$R = \sqrt{(0.075\,m)^2 + (0.10\,m)^2}$

$= 0.125$ m

$F_{2x} = (94.9\,N)\cos 37° = 75.8$ N

(Must be B or E)

$F_{2y} = (94.9\,N)\sin 37° = 57.1$ N

$F_y = F_{1y} + F_{2y} = 311.7\,N + 57.1\,N = 370$ N