|  |
| --- |
| **PH 201 Homework Assignment Chapter on Vectors and Introductory Math Concepts – 21 Problems Total** |
|  |
| **1.** A student sees a newspaper ad for an apartment that has 1330 square feet (ft2) of floor space. How many square meters of area are there? |
|  |
| [Solution for Problem 1](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP01.pdf) |
|  |
| **2.** Suppose a man’s scalp hair grows at a rate of 0.35 mm per day. What is this growth rate in feet per century? |
|  |
| [Solution for Problem 2](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP02.pdf) |
|  |
| **3.** A bottle of wine known as a magnum contains a volume of 1.5 liters. A bottle known as a jeroboam contains 0.792 U.S. gallons. How many magnums are there in one jeroboam? |
|  |
| [Solution for Problem 3](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP03.pdf) |
|  |
| **4.** A partly full paint can has 0.67 U.S. gallons of paint left in it. **(a)** What is the volume of the paint in cubic meters? **(b)** If all the remaining paint is used to coat a wall evenly (wall area = 13 m2), how thick is the layer of wet paint? Give your answer in meters. |
|  |
| [Solution for Problem 4](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP04.pdf) |
|  |
| **5.** A spring is hanging down from the ceiling, and an object of mass *m* is attached to the free end. The object is pulled down, thereby stretching the spring, and then released. The object oscillates up and down, and the time *T* required for one complete up-and-down oscillation is given by the equation $T=2π\sqrt{^{m}/\_{k}}$, where *k* is known as the spring constant. What must be the dimension of *k* for this equation to be dimensionally correct? |
|  |
| [Solution for Problem 5](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP05.pdf) |
|  |
| **6.** You are driving into St. Louis, Missouri, and in the distance you see the famous Gateway to the West arch. This monument rises to a height of 192 m. You estimate your line of sight with the top of the arch to be 2.0° above the horizontal. Approximately how far (in kilometers) are you from the base of the arch? |
|  |
| [Solution for Problem 6](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP06.pdf) |
|  |
|  |
|  |
|  |
| **7.** The drawing shows a person looking at a building on top of which an antenna is mounted. The horizontal distance between the person’s eyes and the building is 85.0 m. In part (*a)* the person is looking at the base of the antenna, and his line of sight makes an angle of 35.0° with the horizontal. In part (*b)* the person is looking at the top of the antenna, and his line of sight makes an angle of 38.0° with the horizontal. How tall is the antenna? |
|  |
|  |
| [Solution for Problem 7](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP07.pdf) |
|  |
| **8.** The drawing shows sodium and chloride ions positioned at the corners of a cube that is part of the crystal structure of sodium chloride (common table salt). The edges of the cube are each 0.281 nm (1 nm = 1 nanometer = 10-9 m) in length. What is the value of the angle *θ*  in the drawing? |
|  |
|  |
| [Solution for Problem 8](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP08.pdf) |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
| **9.** A person is standing at the edge of the water and looking out at the ocean (see the drawing). The height of the person’s eyes above the water is *h* = 1.6 m, and the radius of the earth is *R* = 6.38 x 106 m. **(a)** How far is it to the horizon? In other words, what is the distance *d* from the person’s eyes to the horizon? *(Note: At the horizon the angle between the line of sight and the radius of the earth is 90*°*.)* **(b)** Express this distance in miles. |
|  |
|  |
|  |
| [Solution for Problem 9](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP09.pdf) |
|  |
| **10. (a)** Two workers are trying to move a heavy crate. One pushes on the crate with a force $ \vec{A}$, which has a magnitude of 445 newtons and is directed due west. The other pushes with a force $ \vec{B}$, which has a magnitude of 325 newtons and is directed due north. What are the magnitude and direction of the resultant force $ \vec{A}+\vec{B}$ applied to the crate? **(b)** Suppose that the second worker applies a force $ -\vec{B}$ instead of $ \vec{B}$. What then are the magnitude and direction of the resultant force $ \vec{A}-\vec{B}$applied to the crate? In both cases express the direction relative to due west. |
|  |
| [Solution for Problem 10](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP10.pdf) |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
| **11.** Consider the following four force vectors:$\vec{F\_{1}}=50.0$ newtons, due east$\vec{F\_{2}}=10.0$ newtons, due east$\vec{F\_{3}}=40.0$ newtons, due west$\vec{F\_{4}}=30.0$ newtons, due westWhich two vectors add together to give a resultant with the smallest magnitude, and which two vectors add to give a resultant with the largest magnitude? In each case specify the magnitude and direction of the resultant. |
|  |
| [Solution for Problem 11](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP11.pdf) |
|  |
| **12.** Vector $\vec{A}$ has a magnitude of 12.3 units and points due west. Vector $\vec{B}$ points due north. **(a)** What is the magnitude of $\vec{B}$ if $\vec{A}+\vec{B}$ has a magnitude of 15.0 units? **(b)** What is the direction of $\vec{A}+\vec{B}$ relative to due west? **(c)** What is the magnitude of $\vec{B}$ if $\vec{A}-\vec{B}$ has a magnitude of 15.0 units? **(d)** What is the direction of $\vec{A}-\vec{B}$ relative to due west? |
|  |
| [Solution for Problem 12](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP12.pdf) |
|  |
| **13.** Soccer player #1 is 8.6 m from the goal (see the drawing). If she kicks the ball directly into the net, the ball has a displacement labeled $\vec{A}$. If, on the other hand, she first kicks it to player #2, who then kicks it into the net, the ball undergoes two successive displacements, $\vec{A\_{y}}$ and $\vec{A\_{x}}$. What are the magnitudes and directions of $\vec{A\_{x}}$ and $\vec{A\_{y}}$? |
|  |
|  |
|  |
| [Solution for Problem 13](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP13.pdf) |
|  |
|  |
| **14.** The three displacement vectors in the drawing have magnitudes of *A* = 5.00 m, *B* = 5.00 m, and *C* = 4.00 m. Find the resultant (magnitude and directional angle) of the three vectors by means of the component method. Express the directional angle as an angle above the positive or negative *x* axis. |
|  |
|  |
|  |
| [Solution for Problem 14](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP14.pdf) |
|  |
| **15.** Displacement vector $\vec{A}$ points due east and has a magnitude of 2.00 km. Displacement vector $\vec{B}$points due north and has a magnitude of 3.75 km. Displacement vector $\vec{C}$ points due west and has a magnitude of 2.50 km. Displacement vector $\vec{D}$ points due south and has a magnitude of 3.00 km. Find the magnitude and direction (relative to due west) of the resultant vector $\vec{A}+\vec{B}+\vec{C}+\vec{D}$. |
|  |
| [Solution for Problem 15](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP15.pdf) |
|  |
| **16.** Two geological field teams are working in a remote area. A global positioning system (GPS) tracker at their base camp shows the location of the first team as 38 km away, 19° north of west, and the second team as 29 km away, 35° east of north. When the first team uses its GPS to check the position of the second team, what does the GPS give for the second team’s **(a)** distance from them and **(b)** direction, measured from due east? |
|  |
| [Solution for Problem 16](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP16.pdf) |
|  |
| **17.** A chimpanzee sitting against his favorite tree gets up and walks 51 m due east and 39 m due south to reach a termite mound, where he eats lunch. **(a)** What is the shortest distance between the tree and the termite mound? **(b)** What angle does the shortest distance make with respect to due east? |
|  |
| [Solution for Problem 17](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP17.pdf) |
|  |
|  |
| **18.** The speed of an object and the direction in which it moves constitute a vector quantity known as the velocity. An ostrich is running at a speed of 17.0 m/s in a direction of 68.0° north of west. What is the magnitude of the ostrich’s velocity component that is directed **(a)** due north and **(b)** due west? |
|  |
| [Solution for Problem 18](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP18.pdf) |
|  |
| **19.** The volume of liquid flowing per second is called the volume flow rate *Q* and has the dimensions of [L]3/[T]. The flow rate of a liquid through a hypodermic needle during an injection can be estimated with the following equation:The length and radius of the needle are *L* and *R*, respectively, both of which have the dimension [L]. The pressures at opposite ends of the needle are *P*2 and *P*1, both of which have the dimensions of [M]/{[L][T]2}. The symbol η represents the viscosity of the liquid and has the dimensions of [M]/{[L][T]}. The symbol π stands for pi and, like the number 8 and the exponent *n*, has no dimensions. Using dimensional analysis, determine the value of *n* in the expression for *Q*. |
|  |
| [Solution for Problem 19](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP19.pdf) |
|  |
| **20.** A pilot flies her route in two straight-line segments. The displacement vector $\vec{A}$ for the first segment has a magnitude of 244 km and a direction 30.0° north of east. The displacement vector $\vec{B}$ for the second segment has a magnitude of 175 km and a direction due west. The resultant displacement vector is $\vec{R}=\vec{A}+\vec{B}$ and makes an angle *θ* with the direction due east. Using the component method, find the magnitude of$\vec{R}$ and the directional angle *θ*. |
|  |
| [Solution for Problem 20](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP20.pdf) |
|  |
| **21.** What are the *x* and *y* components of the vector that must be added to the following three vectors, so that the sum of the four vectors is zero? Due east is the+*x* direction, and due north is the +*y* direction.$\vec{A}=113$ units, 60.0° south of west$\vec{B}=222$ units, 35.0° south of east$\vec{C}=177$ units, 23.0° north of east |
|  |
| [Solution for Problem 21](http://physics.nmu.edu/~ddonovan/classes/Nph201/Homework/CHVEC/CHVECP21.pdf) |
|  |
|  |
|  |
|

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |  |
| --- | --- | --- | --- |
|  | [Dr. Donovan's Classes Page](http://physics.nmu.edu/~ddonovan/classes.html) |  | [Dr. Donovan's PH 201 Homework Page](http://physics.nmu.edu/~ddonovan/classes/Nph201/ph201nh.html) |
|  |  |  |  |
|  | [NMU Physics Department Web Page](https://www.nmu.edu/physics/) |  | [NMU Main Page](http://www.nmu.edu/) |

 |
|

|  |
| --- |
| **Please send any comments or questions about this page to** ddonovan@nmu.edu |
| *This page last updated on November 6, 2021* |

 |

 |
|  |