Practice Exam 1

Physics 152

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Can conductors and insulators each be charged?

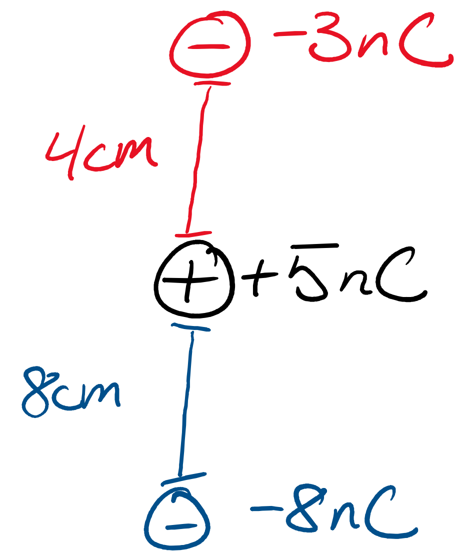
- A) Conductors yes, insulators no
- B) Conductors no, insulators yes
- C) Conductors yes, insulators yes
- D) Conductors no, insulators no

Two electrons are placed a certain distance d apart. Each of the electrons experiences a force of 3E-6 Newtons. How far apart should the electrons be placed?

- A) 8.76E-11 meters
- B) 8.76E-12 meters
- C) 8.76E-13 meters
- D) 8.76E-14 meters

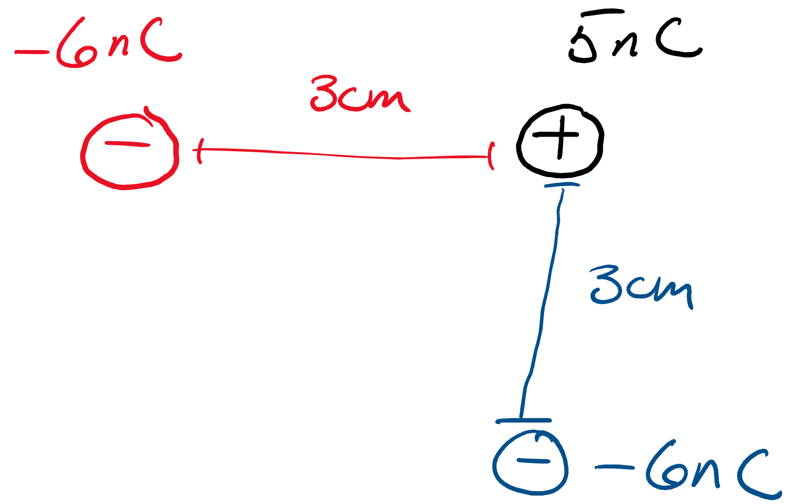
Find the net force on the middle charge (magnitude and direction).

- A) 2.81E-5 N, upwards
- B) 2.81E-5 N, downwards
- C) 1.81E-5 N, upwards
- D) 1.81E-5 N, downwards



Find the direction and magnitude of the force on the black charge.

- A) .0042N, 45 degrees south of west
- B) .0082N, 45 degrees south of west
- C) .0042N, 45 degrees north of east
- D) .0082N, 45 degrees north of east

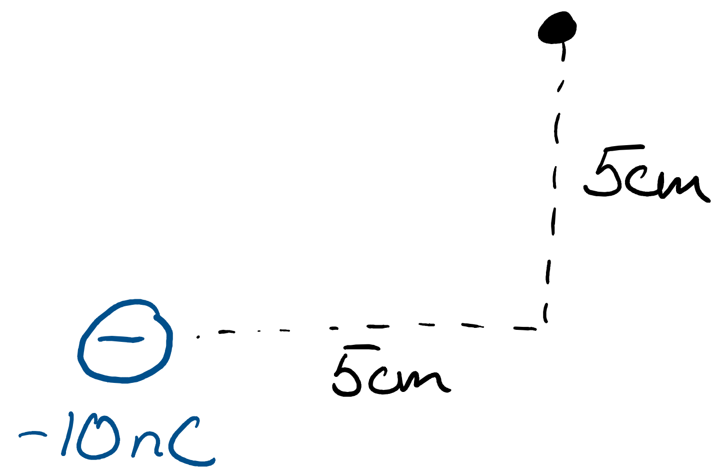


Calculate the direction and size of the electric field 3cm from an electron.

- A) 5000N/C Towards the electron
- B) 5000N/C Away from the electron
- C) 16000N/C Away from the electron
- D) 16000N/C Towards the electron

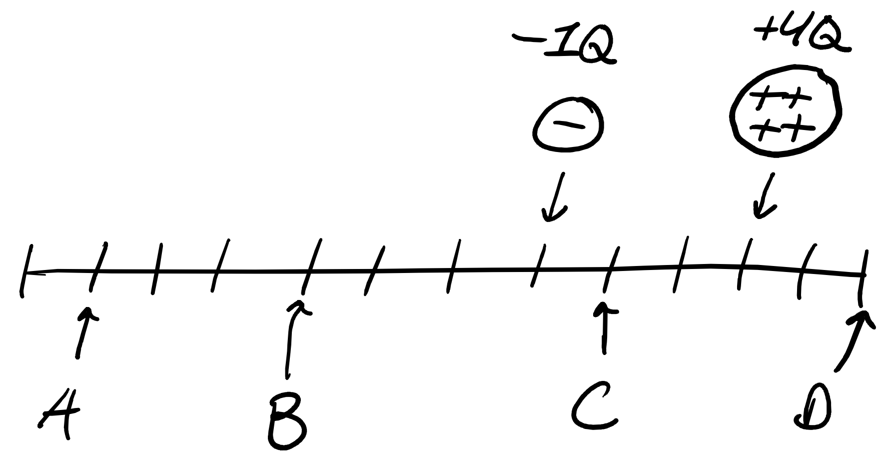
What are the x and y components of the Electric field at the black dot? (In N/C units) (Note- I forget to put signs into my final answer on the practice exam- the answer in my copy should have a negative sign in front of each component)

- A) x: 12625, y: 12625
- B) x: -12625, y: -12625
- C) x: -625, y: -625
- D) x: 625, y: 625



At which point of the diagram below will the electric field be zero?

- A) A
- B) B
- C) C
- D) D



At which point of the diagram below will the electric field be zero?

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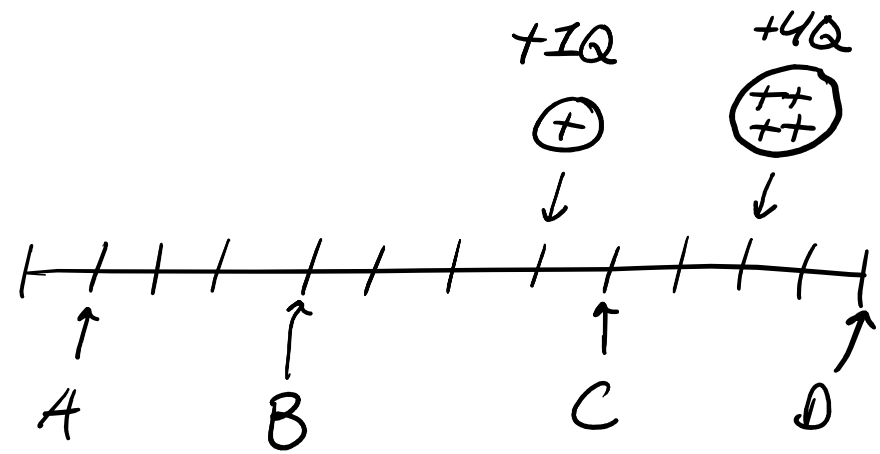
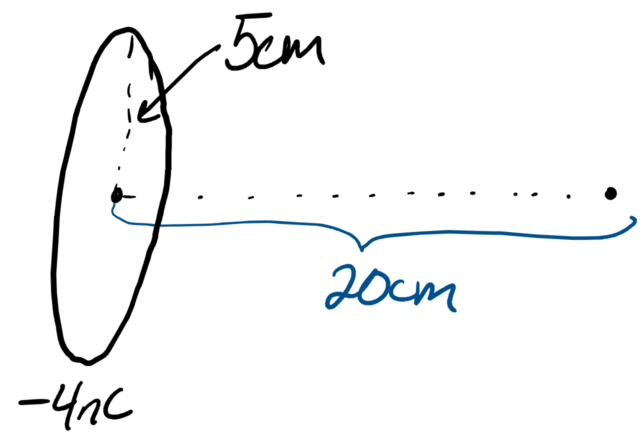


A thin ring (NOT a disk) of radius 5cm and total charge -4nC is shown at right. Find the E field size and direction at a point 20cm away from the ring.

- A) 1822 N/C towards ring
- B) 1822 N/C away from ring
- C) 822 N/C away from ring
- D) 822 N/C towards ring



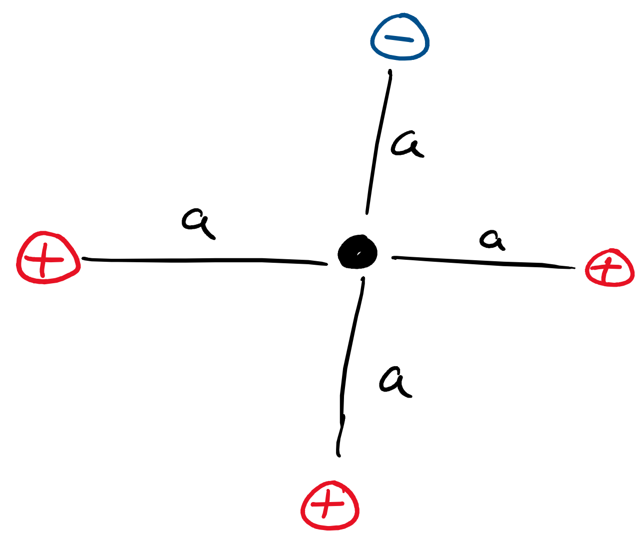
Find the E field 5cm from the SURFACE of a charged spherical shell of radius 4cm, and with surface charge density 4nC/m^2. You will need the formula for surface area of a spherical surface of radius r, which is $A = 4\pi r^2$. Caution- there are two different r's in the problem.

- A) .4 N/C
- B) 9.4 N/C
- C) 80.4 N/C
- D) 89.4 N/C

The E field 4cm away from an infinite wire of charge is 3N/C. What is the charge density of the wire?

- A) 6.67E-12 C/m
- B) 8.67E-12 C/m
- C) 9.67E-12 C/m
- D) 7.67E-12 C/m

Find the direction of the electric field at the black dot.



- A) Up
- B) Down
- C) Zero
- D) Diagonally up and to the right

4C of charge are spread out across a circular disk of radius 5cm. What is the surface charge density?

- A) 509 C/m^2
- B) 519 C/m^2
- C) 529 C/m^2
- D) 539 C/m^2

The charge density on a wire is $\lambda = 8x^2$. If the wire spans from x=1 to x=3, what is the total charge on the wire?

- A) 67.3C
- B) 68.3C
- C) 69.3C
- D) 70.3C

5 Nm^2/C of flux is going into one side of a box, and 2 Nm^2/C is going out of the other side of the box. There are no other fluxes going into/out of the box. What is the charge enclosed in the box?

- A) $-7\epsilon_0$
- B) $-3\epsilon_0$
- C) $+3\epsilon_0$
- D) $+7\epsilon_0$

In order to derive the electric field near a long charged wire, we drew a Gaussian surface. What shape was the shape of the Gaussian surface?

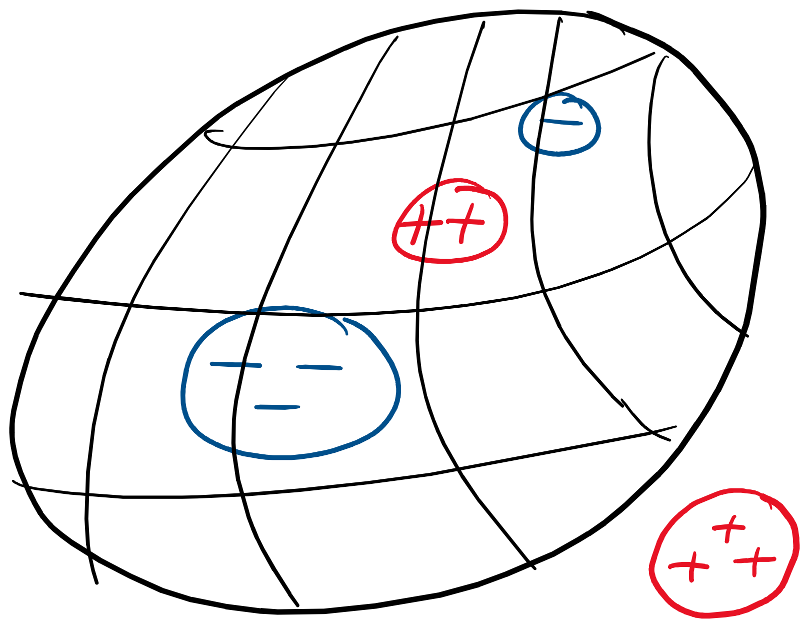
- A) Spherical shell
- B) Cylindrical shell
- C) Box
- D) Gauss' Law cannot be used to derive the formula

What is the value of the electric flux through the circular “caps” of the cylindrical Gaussian surface surrounding a charged wire, and why?

- A) $\pi r^2 E$, since flux is always E*A
- B) 0, since the E field was at an angle of 90 degrees to the surface normal
- C) 0, since the E field on the caps is magnitude zero
- D) 0, since our cylinder was so long that we ignored the caps

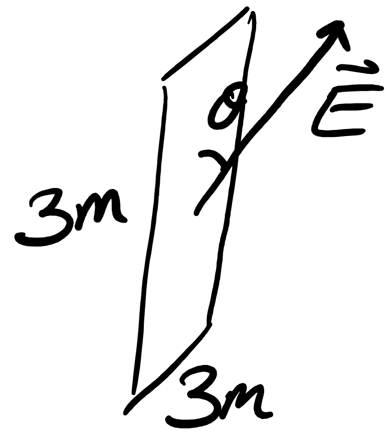
Find the electric flux leaving the black spherical surface drawn at right. Each + or - represents 1C of charge, so there is a -3C, a +2C, and a -1C inside the surface, and a +3C outside.

- A) $-1/\epsilon_0$
- B) $-2/\epsilon_0$
- C) $+2/\epsilon_0$
- D) $+1/\epsilon_0$



Find the magnitude of the electric flux through the square surface shown at the right.

- A) 44.3 Nm^2/C
- B) 45.3 Nm^2/C
- C) 46.3 Nm^2/C
- D) 47.3 Nm^2/C



$E = 8\ N/C$

$\theta = 40°$

EXTRA CREDIT: Find the E field 3cm away from the center of a solid charged ball of radius 8cm, given that its volume charge density is $\rho = 3nC$ per meter cubed.

- A) 2.4N/C
- B) 3.4N/C
- C) 4.4N/C
- D) 5.4N/C

Extra credit: A spherical ball has NON-UNIFORM charge density $\rho(r) = \rho_0 r^2$. Find the expression for the charge enclosed at or below a radius "r", valid for radii within the ball. You will need to use $dV_{sphere} = 4\pi r^2 dr$

- A) $4\pi\rho_0 r^5/5$
- B) $\frac{k\rho_0}{r^2}$
- C) 0
- D) $\pi\rho_0 r^3/2$

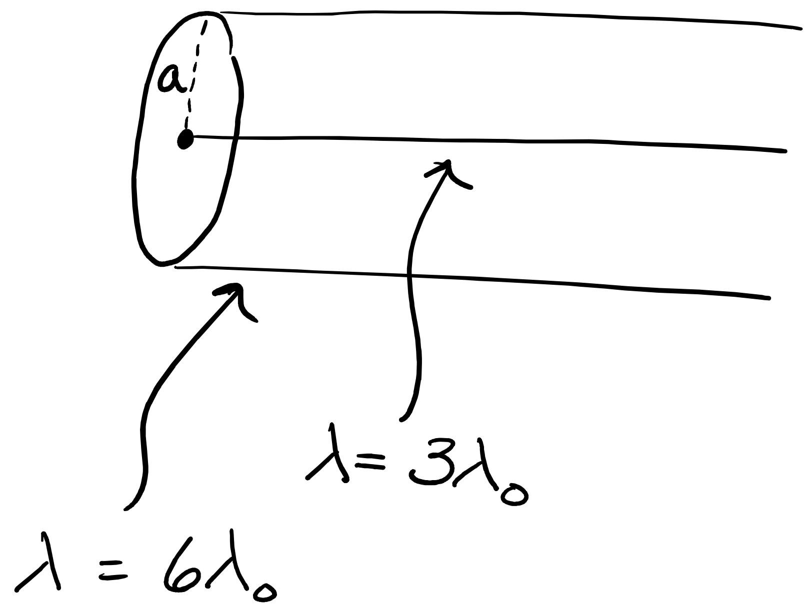
a) Find the expression for the electric field outside the shown charge distribution that is valid for 0<r<a.

- A) 0
- B) $\frac{3\lambda_0}{2\pi\epsilon_0 r}$
- C) $\frac{6\lambda_0}{2\pi\epsilon_0 r}$
- D) $\frac{9\lambda_0}{2\pi\epsilon_0 r}$

a) B) Next, find the expression valid for r>a. λ_0 is a constant.

(Note: The outer shell is hollow, not a solid cylinder.)

- A) 0
- B) $\frac{3\lambda_0}{2\pi\ _0 r}$
- C) $\frac{6\lambda_0}{2\pi\ _0 r}$
- D) $\frac{9\lambda_0}{2\pi\epsilon_0 r}$



The surface charge density on a region of conducting surface is 3C/m^2. Find the E field just outside the surface of the conductor.

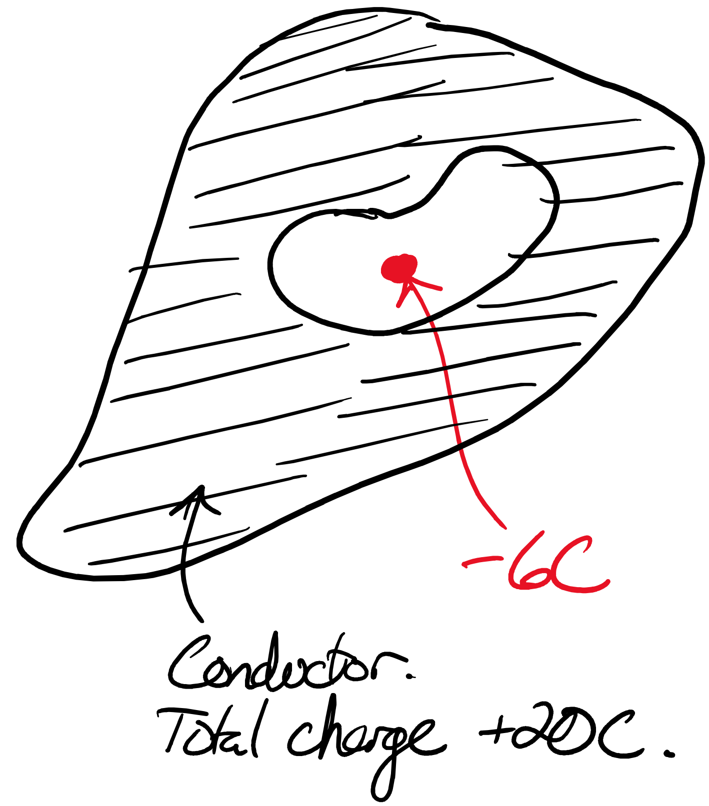
- A) 0
- B) $\frac{3}{\epsilon_0}$
- C) $\frac{3}{2\epsilon_0}$
- D) $\frac{9}{\epsilon_0^2}$

What is true about the electric field inside each region of a cavity conductor (a conductor, with an air hole in the middle)?

- A) The E field inside both the conductor material itself and the air pocket must be zero.
- B) The E field inside both the conductor material itself and the air pocket must be nonzero.
- C) The E field inside the conductor material may be nonzero, but the E field inside the air pocket must be zero.
- D) The E field inside of the conductor material itself must be zero, but inside the air pocket it can be nonzero.

What are the charges on the inner and outer surfaces of the cavity conductor shown in the figure, given that the overall net charge on the conductor is +20C?

- A) Inner: +6, Outer +14
- B) Inner: -6, Outer -14
- C) Inner: -6, Outer +14
- D) Inner: +6, Outer -14

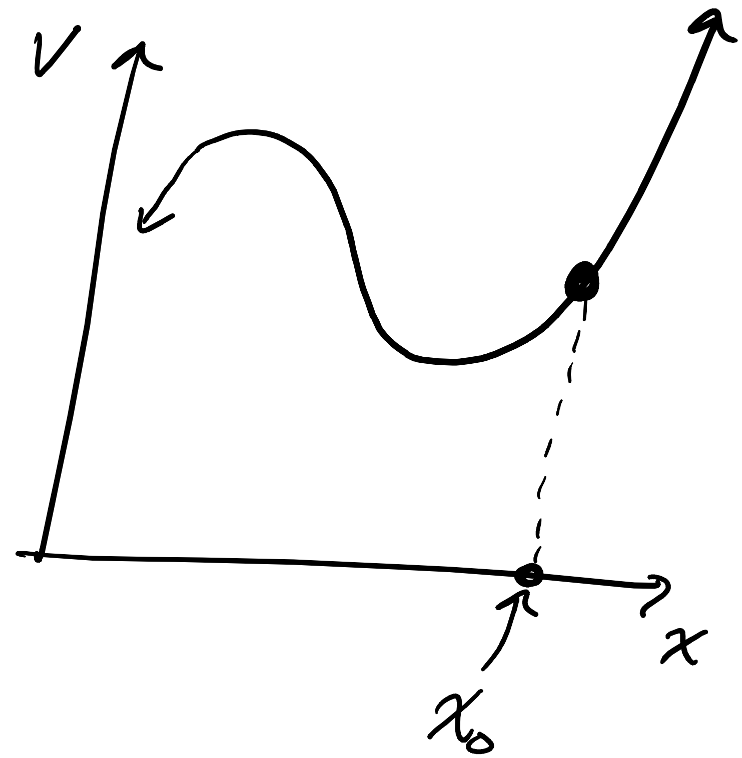


Find the E field strength within a parallel plate capacitor, given that each plate is 2 meters by 2 meters, and the total charge on each plate is plus minus .01 coulombs.

- A) $\frac{.0025}{\epsilon_0}$ N/C
- B) $\frac{25}{\epsilon_0}$ N/C
- C) $\frac{2.5}{\epsilon_0}$ N/C
- D) $\frac{.00025}{\epsilon_0}$ N/C

A voltage graph is shown. What is the direction of the E field at the indicated x value?

- A) Left
- B) Right
- C) Zero
- D) Not enough information



Find the voltage 2cm away from a Helium nucleus (charge +2e).

- A) 7.44E-7 Volts
- B) 6.44E-7 Volts
- C) 3.44E-7 Volts
- D) 1.44E-7 Volts

An electron-volt (eV) is a unit of

- A) Charge
- B) Voltage
- C) Energy
- D) Momentum

Find the voltage drop between the plates of a parallel plate capacitor, given a spacing of 2mm and an electric field strength of 10 kN/C.

- A) 20V
- B) 60V
- C) 600V
- D) 50V

A proton (mass 1.67E-27 kg) starts at rest at a voltage of 0V. It moves to an area of voltage -10V. What is its final speed?

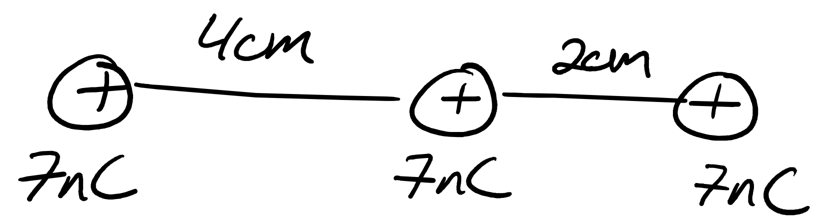
- A) 23775 m/s
- B) 33775 m/s
- C) 43775 m/s
- D) 13775 m/s

Find the potential energy of the red charge, due to the E field created by the black charge.

- A) +4E-6 Joules
- B) -4E-6 Joules
- C) +8E-6 Joules
- D) -8E-6 Joules

Find the energy required to assemble the shown charge distribution.

- A) 4E-5 Joules
- B) 4E-6 Joules
- C) -4E-5 Joules
- D) -4E-6 Joules

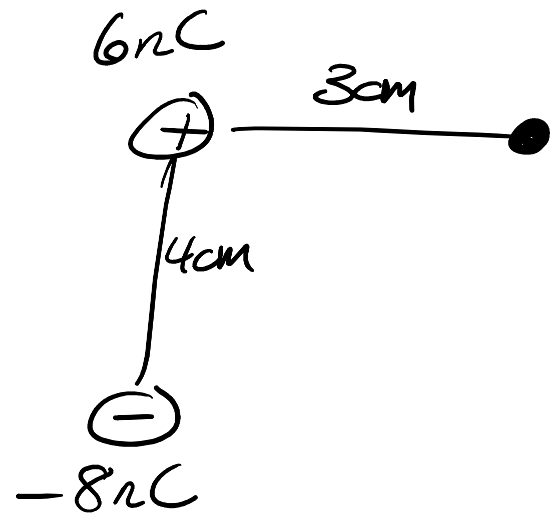


A moving electron is brought to rest using an electric field. Did it move into a region of higher voltage or lower voltage?

- A) Higher
- B) Lower
- C) No change
- D) Impossible to determine

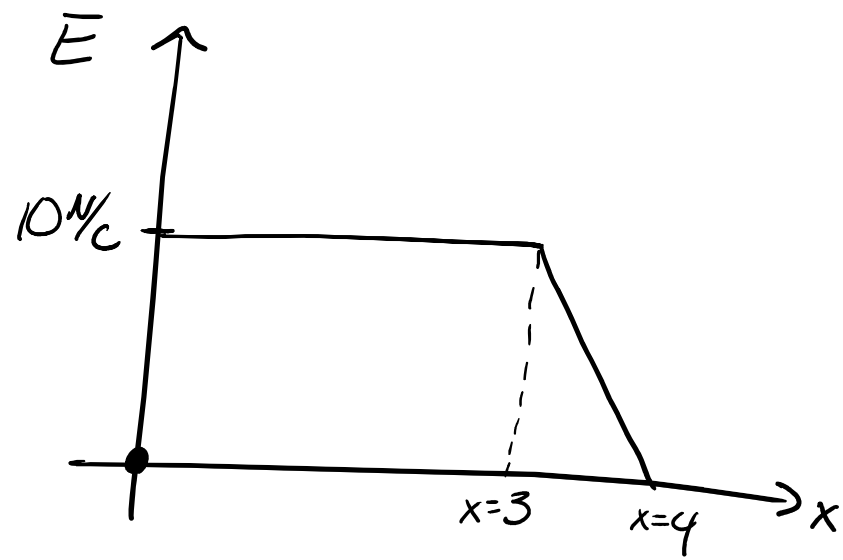
Find the voltage at the black dot.

- A) -1140 Volts
- B) -1240 Volts
- C) -1340 Volts
- D) -1440 Volts



A graph of the electric field is shown. What is the voltage at x=4m, assuming the initial voltage at the origin x=0 was V=-16V? Be very careful with your signs.

- A) -51 V
- B) -31 V
- C) -19V
- D) -35V



A voltage profile has the equation V=3x^2. Find:

a) The equation of the electric field as a function of x.

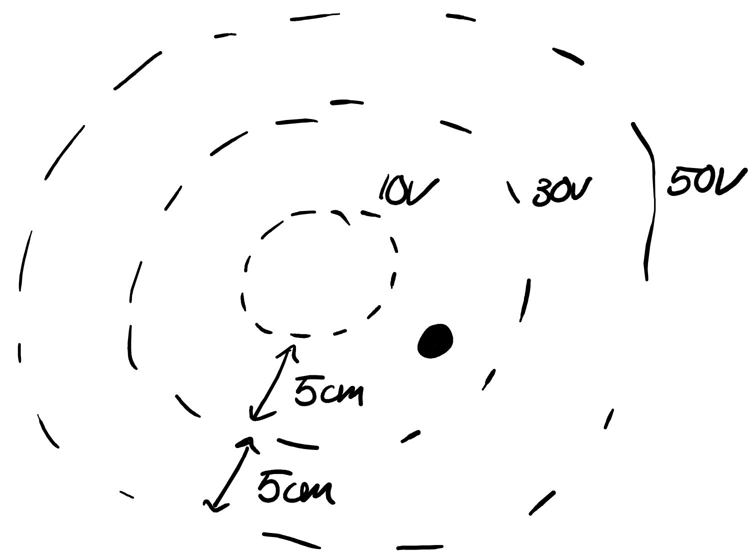
- A) E = 6x
- B) E = x^3
- C) E = -6x
- D) E = -x^3

The E field size AND direction at x=3

- A) -18
- B) -27
- C) 18
- D) 27

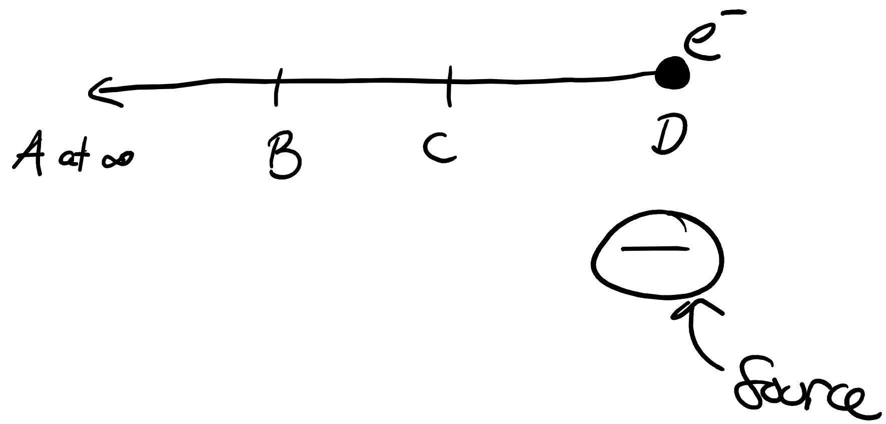
Estimate the E field at the black dot using the equipotential graph shown. The black dashed lines are the equipotentials, at the voltages written on the diagram.

- A) 400 N/C away from center
- B) 400 N/C towards center
- C) 200 N/C away from center
- D) 200 N/C towards center



At which point on the path shown is the electron's KE greatest? Choice A is to be read as "far away at infinity". The source charge is negative.

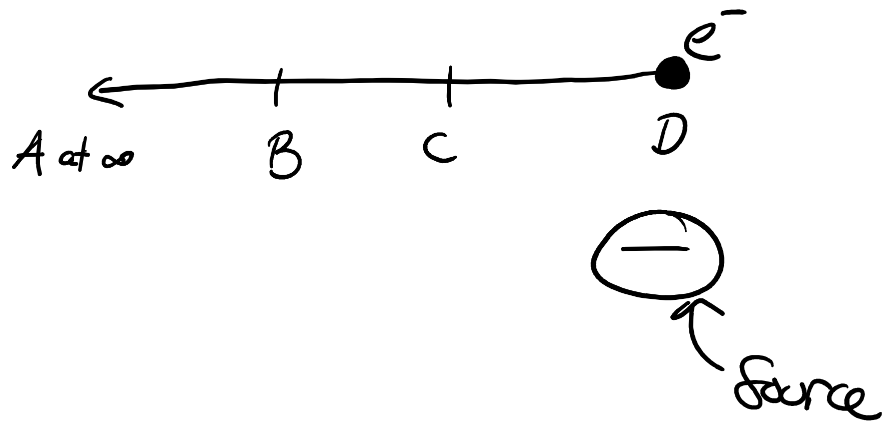
- A) A
- B) B
- C) C
- D) D



Choice A is to be read as "far away at infinity". The source charge is negative.

1) At which point on the path traveled by the electron the voltage the greatest?

- A) A
- B) B
- C) C
- D) D



2) At what point is it the least?

- A) A
- B) B
- C) C
- D) D