

## Fundamentals Of Applied Electromagnetics Solution Manual

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(1) The nuclear force, which is the strongest but only relevant on subatomic scales. (2) The electromagnetic force, which occurs between charged particles on microscopic scales. It is times as strong as... (3) The weak-interaction force, which occurs between radioactive elementary particles. It is ...

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Solution:  $x^3 \hat{e}_x + 3x^2 \hat{e}_y + 3x \hat{e}_z + \hat{e}_3 = F e_{31} + F e_{32}$  Forces  $F e_{31}$  and  $F e_{32}$  are equal in magnitude, with  $F e_{31}$  pointing along 45 above the  $x$  axis and  $F e_{32}$  pointing along 45 below the  $x$  axis. The  $z$  components cancel. Hence,  $F e_{31}$  is along  $+\hat{x} + \hat{z}$ . Fawwaz T. Ulaby and Umberto Ravaioli, Fundamentals of Applied Electromagnetics c 2019 Prentice Hall

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Solution: (a) The green wave has an amplitude of 5 V and a period  $T = 8$  s. Its peak occurs earlier than that of the red wave; hence, its constant phase angle is positive relative to that of the red wave. A full cycle of 8 s corresponds to  $2\pi$  in phase. The green wave crosses the time axis 1 s sooner than the red wave.

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Solution: (d)  $\vec{e}_1 = 3\hat{x} + 3\hat{y} + 3\hat{z}$ ;  $\vec{e}_2 = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_3 = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_4 = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_5 = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_6 = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_7 = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_8 = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_9 = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{10} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{11} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{12} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{13} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{14} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{15} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{16} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{17} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{18} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{19} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ; 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 $\vec{e}_{182} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{183} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{184} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{185} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{186} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{187} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{188} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{189} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{190} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{191} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{192} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{193} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{194} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{195} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{196} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{197} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{198} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{199} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{200} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{201} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{202} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{203} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{204} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{205} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{206} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{207} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{208} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{209} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{210} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{211} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{212} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{213} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{214} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{215} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{216} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{217} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{218} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{219} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{220} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{221} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{222} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{223} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{224} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{225} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{226} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{227} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{228} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{229} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{230} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{231} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{232} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{233} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{234} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{235} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{236} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{237} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{238} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{239} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{240} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{241} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{242} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{243} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{244} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{245} = 3\hat{x} + 3\hat{y} + 146.31\hat{z}$ ;  $\vec{e}_{246} = 3\hat{x} + 3\hat{y} + 146.31$