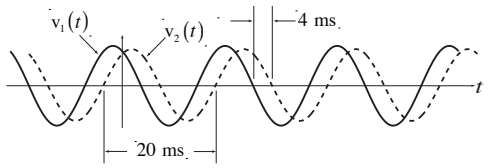
# Solution of ECE 202 Test 1 S13

1. In each case illustrated below find the angle $\theta$ in degrees by which $v_1(t)$ or $V_1$ leads $v_2(t)$ or $V_2$. In each case your answer should lie in the range $-180° \le \theta \le +180°$.

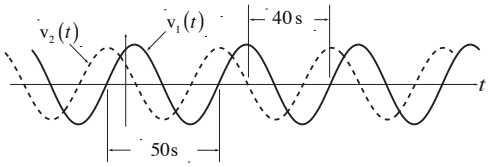
(a) $\theta$ = _____ °




$$20 \text{ ms} \rightarrow 2\pi \text{ radians or } 360° \Rightarrow 4 \text{ ms} \rightarrow \frac{2\pi}{5} \text{ radians or } \frac{360°}{5} = 72°$$

$$\therefore v_1(t) \text{ leads } v_2(t) \text{ by } 72°$$

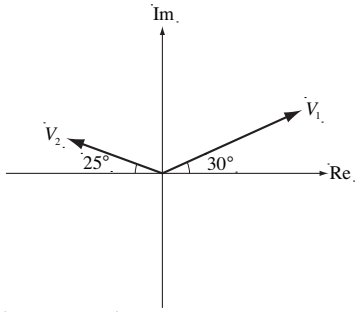
(b) $\theta$ = _____ °




$$50 \text{ s} \rightarrow 2\pi \text{ radians or } 360° \Rightarrow 40 \text{ s} \rightarrow \frac{4 \times 2\pi}{5} \text{ radians or } \frac{4 \times 360°}{5} = 288°$$

$$\therefore v_2(t) \text{ leads } v_1(t) \text{ by } 288° - 180° = 108° \Rightarrow v_1(t) \text{ leads } v_2(t) \text{ by } -108°$$

(c) $\theta$ = _____ °




$$V_2 \text{ leads } V_1 \text{ by } (180° - 25°) - 30° = 125° \Rightarrow V_1 \text{ leads } V_2 \text{ by } -125°$$

2. Express each of the following numbers or expressions as a single complex number in polar form (magnitude and angle).

(a) $j24 =$ _____ $\angle$ _____ ° $24\angle 90°$

(b) $6 + j11 =$ _____ $\angle$ _____ ° $12.53\angle 61.3895°$

(c) $\dfrac{9\angle 48°}{2 + j} =$ _____ $\angle$ _____ ° $4.0239\angle 21.4349°$

(d) $\left(3e^{j85°}\right)(1 - j) =$ _____ $\angle$ _____ ° $4.2426\angle 40°$

3. Find the phasor equivalent of each of these voltages or currents. (Remember, the zero-angle reference for phasors is an unshifted cosine.) In each case the angle $\theta$ should lie in the range $-180° \le \theta \le +180°$.

(a) $\mathrm{v}(t) = 18\sin(200\pi t - 30°) \rightarrow V =$ _____ $\angle$ _____ ° $18\angle -120°$

(b) $\mathrm{i}(t) = -13\cos(20t + 140°) \rightarrow I =$ _____ $\angle$ _____ ° $13\angle -40°$

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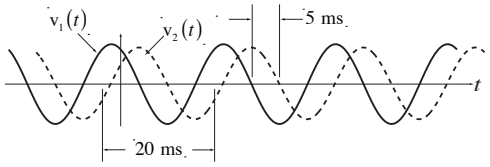
1. In each case illustrated below find the angle $\theta$ in degrees by which $v_1(t)$ or $V_1$ leads $v_2(t)$ or $V_2$. In each case your answer should lie in the range $-180° \le \theta \le +180°$.

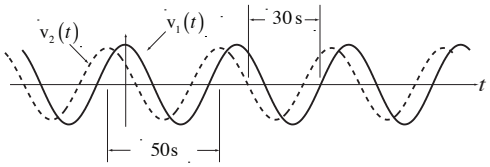
(a) $\theta$ = _____ °




$$20 \text{ ms} \to 2\pi \text{ radians or } 360° \Rightarrow 5 \text{ ms} \to \frac{2\pi}{4} \text{ radians or } \frac{360°}{4} = 90°$$

$$\therefore v_1(t) \text{ leads } v_2(t) \text{ by } 90°$$

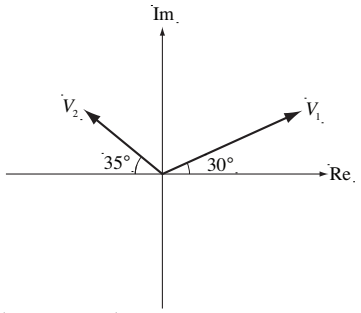
(b) $\theta$ = _____ °




$$50 \text{ s} \to 2\pi \text{ radians or } 360° \Rightarrow 30 \text{ s} \to \frac{3 \times 2\pi}{5} \text{ radians or } \frac{3 \times 360°}{5} = 216°$$

$$\therefore v_2(t) \text{ leads } v_1(t) \text{ by } 216° - 180° = 36° \Rightarrow v_1(t) \text{ leads } v_2(t) \text{ by } -36°$$

(c) $\theta$ = _____ °




$$V_2 \text{ leads } V_1 \text{ by } (180° - 35°) - 30° = 115° \Rightarrow V_1 \text{ leads } V_2 \text{ by } -115°$$

2. Express each of the following numbers or expressions as a single complex number in polar form (magnitude and angle).

(a) $j18 =$ _____ $\angle$ _____ ° $18\angle 90°$

(b) $4 + j13 =$ _____ $\angle$ _____ ° $13.60\angle 72.8973°$

(c) $\dfrac{11\angle 38°}{2 + j4} =$ _____ $\angle$ _____ ° $2.4597\angle -25.4349°$

(d) $\left(3e^{j85°}\right)(1 - j2) =$ _____ $\angle$ _____ ° $6.7082\angle 21.5651°$

3. Find the phasor equivalent of each of these voltages or currents. (Remember, the zero-angle reference for phasors is an unshifted cosine.) In each case the angle $\theta$ should lie in the range $-180° \le \theta \le +180°$.

(a) $\mathrm{v}(t) = 18\sin(200\pi t - 40°) \rightarrow V =$ _____ $\angle$ _____ ° $18\angle -130°$

(b) $\mathrm{i}(t) = -13\cos(20t + 120°) \rightarrow I =$ _____ $\angle$ _____ ° $13\angle -60°$

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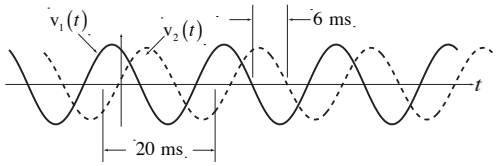
1. In each case illustrated below find the angle $\theta$ in degrees by which $v_1(t)$ or $V_1$ leads $v_2(t)$ or $V_2$. In each case your answer should lie in the range $-180° \le \theta \le +180°$.

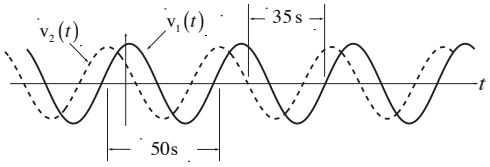
(a) $\theta$ = _____ °




$$20 \text{ ms} \rightarrow 2\pi \text{ radians or } 360° \Rightarrow 6 \text{ ms} \rightarrow \frac{3\times 2\pi}{10} \text{ radians or } \frac{3\times 360°}{10} = 108°$$

$$\therefore v_1(t) \text{ leads } v_2(t) \text{ by } 108°$$

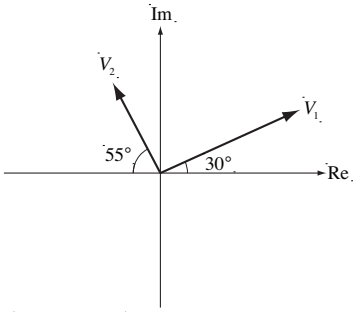
(b) $\theta$ = _____ °




$$50 \text{ s} \rightarrow 2\pi \text{ radians or } 360° \Rightarrow 35 \text{ s} \rightarrow \frac{7\times 2\pi}{10} \text{ radians or } \frac{7\times 360°}{10} = 252°$$

$$\therefore v_2(t) \text{ leads } v_1(t) \text{ by } 252° - 180° = 72° \Rightarrow v_1(t) \text{ leads } v_2(t) \text{ by } -72°$$

(c) $\theta$ = _____ °




$$V_2 \text{ leads } V_1 \text{ by } (180° - 55°) - 30° = 95° \Rightarrow V_1 \text{ leads } V_2 \text{ by } -95°$$

2. Express each of the following numbers or expressions as a single complex number in polar form (magnitude and angle).

(a) $j9 =$ _____ $\angle$ _____ ° $9\angle 90°$

(b) $2 - j11 =$ _____ $\angle$ _____ ° $11.18\angle -79.695°$

(c) $\dfrac{7\angle 68°}{5 + j} =$ _____ $\angle$ _____ ° $1.3728\angle 56.6901°$

(d) $\left(3e^{j55°}\right)(3 - j) =$ _____ $\angle$ _____ ° $9.4868\angle 36.5651°$

3. Find the phasor equivalent of each of these voltages or currents. (Remember, the zero-angle reference for phasors is an unshifted cosine.) In each case the angle $\theta$ should lie in the range $-180° \le \theta \le +180°$.

(a) $\mathrm{v}(t) = 18\sin(200\pi t + 40°) \rightarrow V =$ _____ $\angle$ _____ ° $18\angle -50°$

(b) $\mathrm{i}(t) = -13\cos(20t + 80°) \rightarrow I =$ _____ $\angle$ _____ ° $13\angle -100°$