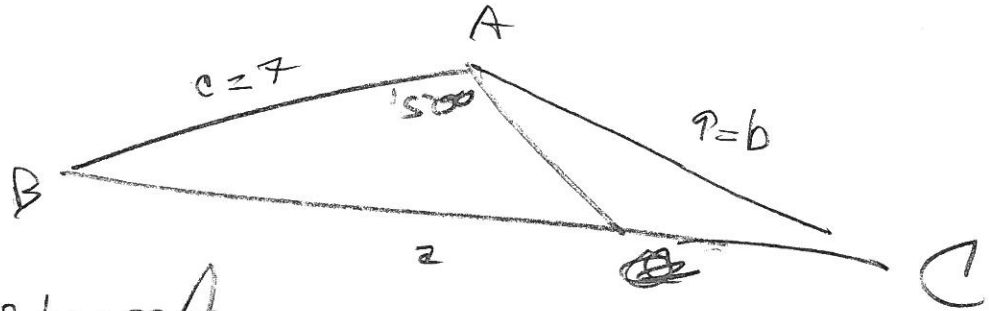


① ② 5pts

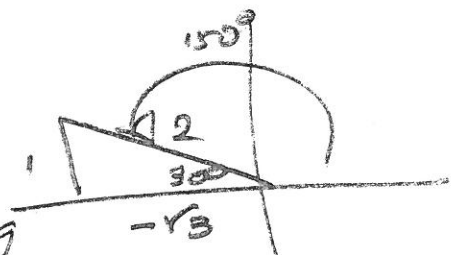


$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$= 7^2 + 9^2 - 2(7)(9) \cos(150^\circ)$$

$$\approx 239.1192009 \rightarrow$$

$$a \approx 15.4635 \text{ cm} \approx 15.46347959$$



$$= 130 - 126 \left(-\frac{\sqrt{3}}{2}\right) = 130 + 63\sqrt{3}$$

③ 5pts

$$\frac{\sin B}{b} = \frac{\sin A}{a} \rightarrow$$

$$\sin B = \frac{b \sin A}{a} \approx \frac{9 \sin(150^\circ)}{15.46347959}$$

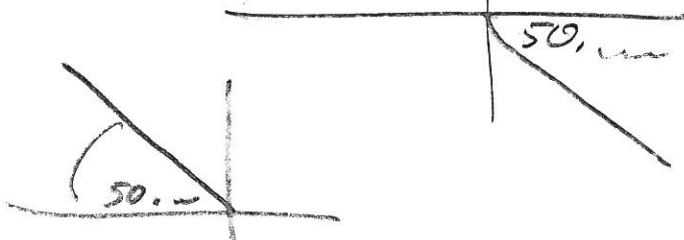
$$\rightarrow B \approx \arcsin\left(\frac{9 \sin(150^\circ)}{15.46347959}\right)$$

$$\approx 16.9183276^\circ \approx 16.9183^\circ$$

(2) (2) (5pts) $\vec{u} = \langle -7-2, 3-(-8) \rangle$
 $= \langle -9, 11 \rangle = \vec{u}$

(b) (5pts) $\|\vec{u}\| = \sqrt{(-9)^2 + 11^2} = \sqrt{81 + 121} = \sqrt{202} = \|\vec{u}\|$

(c) (5pts) $\tan^{-1}\left(\frac{11}{-9}\right) \approx -50.71059314$ arc tan ans
 We want =

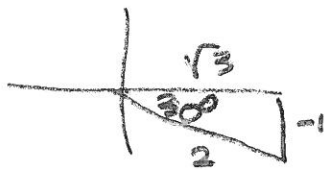


So $180^\circ - 50.7 \approx 129.2894069^\circ$
 $\approx 129.2894^\circ \approx \oplus$

(3) (2) (5pts) $\vec{u} = \langle 3, -2 \rangle$
 $= 3\vec{i} - 2\vec{j} = \vec{u}$

(b) (5pts) Resultant

4 (2) 5 pts



$$\vec{u} = 5 \left\langle \cos \frac{\pi}{2}, \sin \frac{\pi}{2} \right\rangle$$

$$= 5 \langle 0, 1 \rangle = \boxed{\langle 0, 5 \rangle = \vec{u}}$$

$$\vec{v} = 10 \left\langle \cos \left(-\frac{\pi}{6} \right), \sin \left(-\frac{\pi}{6} \right) \right\rangle$$

$$= 10 \left\langle \frac{\sqrt{3}}{2}, -\frac{1}{2} \right\rangle$$

$$= \boxed{\langle 5\sqrt{3}, -5 \rangle = \vec{v}}$$

b) 5 pts

$$\vec{u} + \vec{v} = \langle 5\sqrt{3}, 0 \rangle$$

$$\|\vec{u} + \vec{v}\| = 5\sqrt{3}$$

Direction is Due East!

5 a) 5 pts

$$2 \mid 2 \quad -9 \quad 14 \quad -5$$

$$\underline{\quad \quad \quad 4 \quad -10 \quad 8}$$

$$2 \quad -5 \quad 4 \quad \boxed{3 = f(2)}$$

b) 5 pts

$$2+i \mid 2 \quad -9 \quad 14 \quad -5$$

$$\underline{\quad \quad \quad 4+2i \quad -12-i \quad 5}$$

$$2-i \mid 2 \quad -5+2i \quad 2-i \quad 0$$

$$\underline{\quad \quad \quad 4-2i \quad -2+i}$$

$$2 \quad -1 \quad 0$$

$$(-5+2i)(2+i)$$

$$= -10 -5i + 4i -2$$

$$= -12 -i$$

$$(2-i)(2+i) = 2^2 + 1 = 5$$

See?
 Answer to (b)
 $r=0 \Rightarrow$
 $2+i$ is a zero.

c) 5 pts

$$f(x) = (2x-1)(x-(2+i))(x-(2-i))$$

(6) (a) (5 pts) $z = -4 - 4\sqrt{3}i \Rightarrow$

$$\boxed{z + \bar{z} = -8} \quad \& \quad z\bar{z} = 4^2 + (4\sqrt{3})^2$$

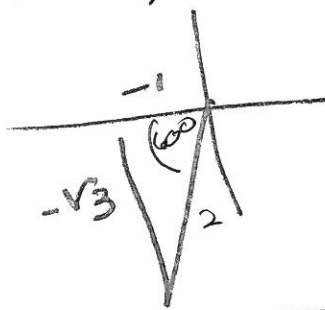
$$= 16 + 16 \cdot 3$$

$$= \boxed{64 = z\bar{z}}$$

(b) (5 pts) $z = -4 - 4\sqrt{3}i$

$$\arctan\left(\frac{-4\sqrt{3}}{-4}\right) = \arctan(\sqrt{3}) = \frac{\pi}{3} = 60^\circ$$

But $z \in \text{QIII}$, so reference angle is 60° , but QIII



$$180^\circ + 60^\circ = 240^\circ$$

$$\pi + \frac{\pi}{3} = \frac{4\pi}{3}$$

$$|z| = \sqrt{4^2 + (4\sqrt{3})^2} = \sqrt{64} = 8$$

$$\text{So, } \boxed{z = 8 \left(\cos \frac{4\pi}{3} + i \sin \frac{4\pi}{3} \right)}$$

$$(7) z = 27 \left(\cos \frac{3\pi}{4} + i \sin \frac{3\pi}{4} \right)$$

$$(2) \quad = 27 \left(-\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} i \right)$$

5 pts



$$= \boxed{-\frac{27}{\sqrt{2}} + \frac{27}{\sqrt{2}} i}$$

(b) 5 pts

$$\sqrt[3]{z} = 3 \left(\cos \left(\frac{\pi}{4} \right) + i \sin \left(\frac{\pi}{4} \right) \right)$$

(c) 5 pts

$$\frac{3\pi}{3} = \frac{6\pi}{12} \quad \frac{\pi}{4} = \frac{3\pi}{12} \quad \textcircled{3} + 3 = 11$$

$$3 \left(\cos \left(\frac{11\pi}{12} \right) + i \sin \left(\frac{11\pi}{12} \right) \right),$$

$$3 \left(\cos \left(\frac{19\pi}{12} \right) + i \sin \left(\frac{19\pi}{12} \right) \right)$$

5 pts

$$z^2 = 729 \left(\cos \left(\frac{3\pi}{2} \right) + i \sin \left(\frac{3\pi}{2} \right) \right) \quad 2 \left(\frac{3\pi}{4} \right) = \frac{3\pi}{2}$$

(e) 5 pts

$$w = 3 \left(\cos \left(\frac{\pi}{6} \right) + i \sin \left(\frac{\pi}{6} \right) \right) \rightarrow$$

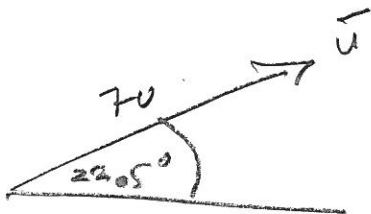
$$zw = (27)(3) \left(\cos \left(\frac{\pi}{6} + \frac{3\pi}{4} \right) + i \sin \left(\frac{\pi}{6} + \frac{3\pi}{4} \right) \right)$$

$$= \boxed{81 \left(\cos \left(\frac{11\pi}{12} \right) + i \sin \left(\frac{11\pi}{12} \right) \right) = zw}$$

122

E3

B1 @
Sob



$$\vec{u} = \langle 70 \cos(22.5^\circ), 70 \sin(22.5^\circ) \rangle$$

$$\approx \langle 64.67156728, 26.78784027 \rangle$$

$$\approx \langle \underline{64.6716}, \underline{26.7878} \rangle$$

horizontal
component

vertical
component

(b)

$$\sin(22.5^\circ) = \sqrt{\frac{1 - \cos(45^\circ)}{2}}$$

$$= \sqrt{\frac{1 - \frac{1}{\sqrt{2}}}{2}} = \sqrt{\frac{\frac{\sqrt{2}-1}{\sqrt{2}}}{2}} = \sqrt{\frac{2-\sqrt{2}}{4}} = \frac{\sqrt{2-\sqrt{2}}}{2}$$

$$\cos(22.5^\circ) = \dots = \frac{\sqrt{2+\sqrt{2}}}{2}, \text{ so}$$

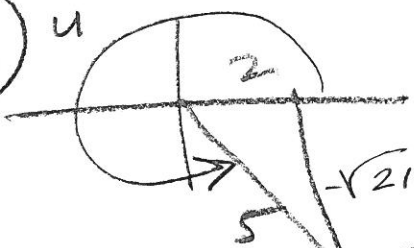
$$\vec{u} = \langle 35\sqrt{2+\sqrt{2}}, 35\sqrt{2-\sqrt{2}} \rangle$$

122

B2

$$\cos(u) = \frac{2}{5} \quad \& \quad \sin(u) < 0$$

5 pts



$$\frac{3\pi}{2} < u < 2\pi$$

$$\frac{3\pi}{4} < u < \pi$$

SO Q II



$$\sin\left(\frac{u}{2}\right) = \sqrt{\frac{1 - \frac{2}{5}}{2}}$$

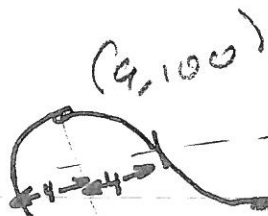
$$= \sqrt{\frac{3}{10}} = \frac{\sqrt{30}}{10} = \sin\left(\frac{u}{2}\right)$$

$$\cos\left(\frac{u}{2}\right) = -\sqrt{\frac{1 + \frac{2}{5}}{2}} = -\sqrt{\frac{7}{10}} = -\frac{\sqrt{70}}{10} = \cos\left(\frac{u}{2}\right)$$

$$\tan\left(\frac{u}{2}\right) = \frac{\frac{\sqrt{30}}{10}}{-\frac{\sqrt{70}}{10}} = -\sqrt{\frac{3}{7}} = -\frac{\sqrt{21}}{7} = \tan\left(\frac{u}{2}\right)$$

B3

5 pts



$$\text{Amp} = \frac{220}{2} = 110$$

$$y = \frac{100 - 120}{2} = -\frac{20}{2} = -10$$

$$110 \sin\left(\frac{\pi}{8}(x-5)\right) - 10$$

$$f(x) = 110 \cos\left(\frac{\pi}{8}(x-9)\right) - 10$$

(B4)

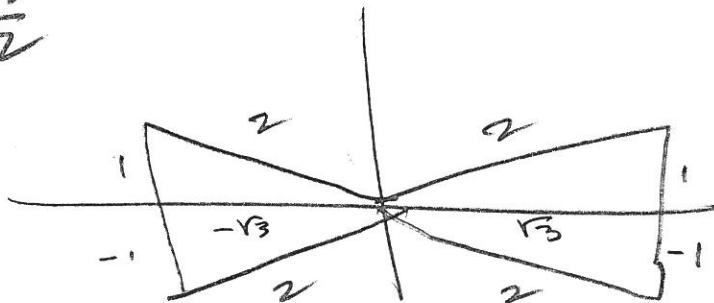
$$4\cos^2(2x) - 3 = 0$$

$$x \in [0, 2\pi) \rightarrow$$

$$\cos^2(2x) = \frac{3}{4}$$

$$2x \in [0, 4\pi)$$

$$\cos(2x) = \pm \frac{\sqrt{3}}{2}$$



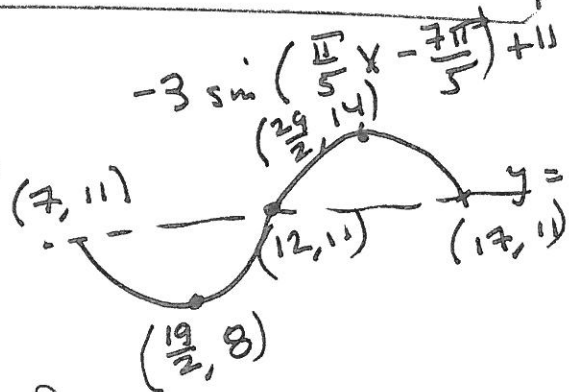
$$2x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}, \frac{13\pi}{6}, \frac{17\pi}{6}, \frac{19\pi}{6}, \frac{23\pi}{6}$$

$$\Rightarrow x \in \left\{ \frac{\pi}{12}, \frac{5\pi}{12}, \frac{7\pi}{12}, \frac{11\pi}{12}, \frac{13\pi}{12}, \frac{17\pi}{12}, \frac{19\pi}{12}, \frac{23\pi}{12} \right\}$$

(B5)

$$y = 4 \sin\left(\frac{\pi}{5}x - \frac{7\pi}{5}\right) + 11$$

$$= 4 \sin\left(\frac{\pi}{5}(x-7)\right) + 11$$

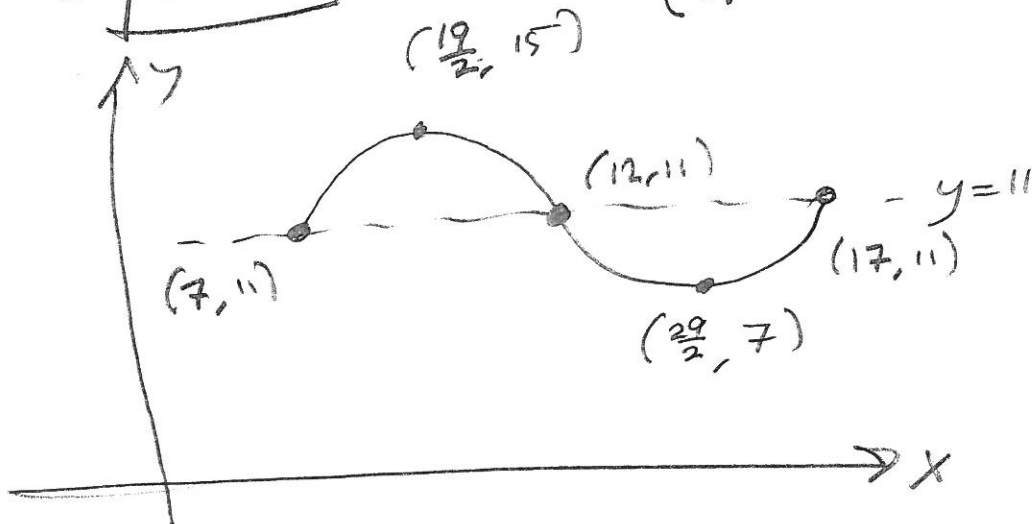


$$\frac{\pi}{5}x = 2\pi \Rightarrow x = 10 = T$$

Amp = 4

start = 7

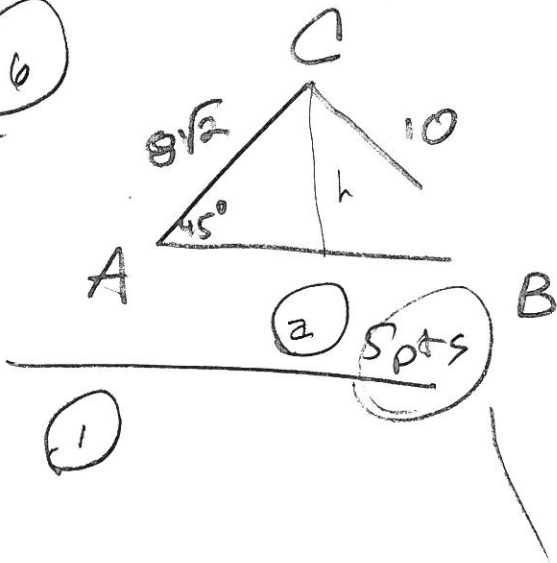
mid = y = 11



122

E3

(B6)



$$h = 8\sqrt{2} \sin 45^\circ$$

$$= 8\sqrt{2} \cdot \frac{1}{\sqrt{2}} = 8$$

$$8\sqrt{2} \approx 11.3137,$$

So

$$h = 8 < a = 10 < b \approx 11.3$$

→ 2 solutions

(b) (5 pts)

$$\frac{\sin B}{b} = \frac{\sin A}{a}$$

$$B = \arcsin\left(\frac{(8\sqrt{2})\left(\frac{1}{\sqrt{2}}\right)}{10}\right)$$

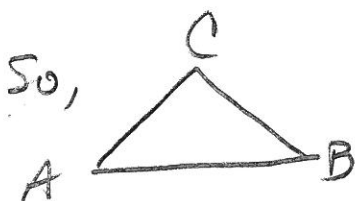
$$\approx 53.13010235^\circ$$

$$\rightarrow C \approx 180^\circ - 53.13010235^\circ - 45^\circ$$

$$C \approx 81.86989765^\circ$$

$$\frac{c}{\sin C} = \frac{a}{\sin A} \rightarrow$$

$$c = \frac{a \sin C}{\sin A} = \frac{10 \sin C}{\sin A} \approx 14$$



$$a = 10$$

$$b = 8\sqrt{2}$$

$$c \approx 14$$

$$A = 45^\circ$$

$$B \approx 53.1301^\circ$$

$$C \approx 81.8699^\circ$$

122

E3

B_6 ant'd

For 2nd case

B is obtuse:

$$B = 180^\circ - \text{old } B$$

$$\approx 180^\circ - 53.2^\circ \approx 126.8698976^\circ$$

$$\rightarrow C = 180^\circ - A - B$$

$$\approx 180^\circ - 45^\circ - 126.8698976^\circ$$

$$\approx 8.130102354^\circ$$

$$c = \frac{a \sin C}{\sin A} \approx \frac{10 \sin(8.130102354^\circ)}{\sin 45^\circ} \approx 2$$

$$A = 45^\circ$$

$$B \approx 126.8699^\circ$$

$$C \approx 8.1301^\circ$$

$$a = 10$$

$$b = 8\sqrt{2}$$

$$c \approx 2$$

