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Question 1

$$8e^{3x-2} = 13$$

Solution:

$$e^{3x-2} = \frac{13}{8}$$

$$3x-2 = \ln\left(\frac{13}{8}\right)$$

$$3x = \ln\left(\frac{13}{8}\right) + 2$$

$$x \Rightarrow \frac{\ln\left(\frac{13}{8}\right) + 2}{3}$$

$$\approx \underline{\underline{0.829}}$$

Question 2

$$\log_4(x+10) - \log_4(x+7) = 3$$

Solution:

$$\log_4(x+10) = 3 + \log_4(x+7)$$

$$\Rightarrow x+10 = 64(x+7)$$

$$\Rightarrow x = \underline{\underline{-\frac{146}{21}}}$$

Problem 3

- (1) $\frac{1}{2}$ life = 68.9
initial Amount = 25.

$$Q(t) = P e^{rt}$$

solution

$$Q = \frac{P}{2} \quad r(68.9)$$
$$\frac{P}{2} = P e$$

$$\frac{1}{2} = e^{68.9r}$$

$$\Rightarrow r = \frac{\ln(\frac{1}{2})}{68.9}$$

$$= -0.01006019$$

$$\Rightarrow Q(t) = \underline{\underline{25 e^{-0.01006019(t)}}}$$

- (2) Time when remaining amount is 2 kg.

solution

$$2 = 25 e^{-0.01006019(t)}$$

$$t = \frac{\ln\left(\frac{25}{2}\right)}{0.01006019} \approx 251.06169147$$
$$\approx \underline{\underline{251.062}}$$

Problem 4.



$$\sin u = \frac{2}{3}$$

Solution.

$\cos u$

$$\cos u = \sqrt{1 - \sin^2 u}$$

$$= \sqrt{1 - \frac{4}{9}} = \sqrt{\frac{5}{9}}$$

$$\approx \frac{\sqrt{5}}{3} \text{ but } \cos u = -ve \text{ sine in II quadrant}$$

$$\Rightarrow \cos u = \boxed{-\frac{\sqrt{5}}{3}}$$

$$\underline{\tan u} = \frac{\sin u}{\cos u}$$

$$= \frac{2/3}{-\sqrt{5}/3} = -\frac{2}{\sqrt{5}} = \boxed{-\frac{2\sqrt{5}}{5}}$$

$$\underline{u} = \sin^{-1}\left(\frac{2}{3}\right)$$

$$\approx \underline{\underline{41.81^\circ}}$$

Problem 5



$$\tan(\alpha) = -\frac{5}{4}$$

$$\sin(\beta) = -\frac{3}{5}$$

$$\text{now } \sin \beta = -\frac{3}{5}$$

$$\cos \beta = -\frac{12}{25}$$

$$\tan \beta = -\frac{5}{4}$$

$$\sin \alpha = \frac{5\sqrt{41}}{41}$$

$$\cos \alpha = -\frac{4\sqrt{41}}{41}$$

$$\tan \alpha = -\frac{5}{4}$$

(a) $\sin(\alpha + \beta)$

$$\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$$

$$= \left(\frac{5\sqrt{41}}{41} \right) \left(-\frac{12}{25} \right) + \left(-\frac{4\sqrt{41}}{41} \right) \left(-\frac{3}{5} \right)$$

$$= \left(\frac{5\sqrt{41}}{41} \right) \left(-\frac{12}{25} \right) + \left(-\frac{4\sqrt{41}}{41} \right) \left(-\frac{3}{5} \right)$$

$$= -\frac{9\sqrt{41}}{205}$$

$$\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$$

$$= \left(-\frac{4\sqrt{41}}{41} \right) \left(-\frac{12}{25} \right) - \left(\frac{5\sqrt{41}}{41} \right) \left(-\frac{3}{5} \right)$$

$$= \frac{3\sqrt{41}}{25}$$

$$\tan(\alpha + \beta) = \frac{\tan \alpha + \tan \beta}{1 - \tan \alpha \tan \beta} = \frac{\left(-\frac{5}{4} \right) + \left(-\frac{5}{4} \right)}{1 - \left(-\frac{5}{4} \right) \left(-\frac{5}{4} \right)}$$

Problem 6

$$\tan \alpha = \frac{3}{7}, \quad 0 < \alpha < \frac{\pi}{2}$$

$$\sin \left(\frac{\alpha}{2} \right) =$$

$$\cos \left(\frac{\alpha}{2} \right) =$$

$$\tan \left(\frac{\alpha}{2} \right)$$

Problem 5

$\tan \alpha = -\frac{5}{4}$ $\sin \beta = -\frac{3}{8}$ α  $-\frac{3}{8}$	now $\tan \alpha = -\frac{5}{4}$ $\sin \alpha = \frac{5\sqrt{41}}{41}$ $\cos \alpha = -\frac{4\sqrt{41}}{41}$	$\sin \beta = -\frac{3}{8}$ $\cos \beta = -\frac{\sqrt{55}}{8}$ $\tan \beta = \frac{3\sqrt{55}}{55}$
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(9) $\sin(\alpha + \beta)$

$$= \sin \alpha \cos \beta + \cos \alpha \sin \beta$$

$$= \left(\frac{5\sqrt{41}}{41}\right)\left(-\frac{\sqrt{55}}{8}\right) + \left(-\frac{4\sqrt{41}}{41}\right)\left(-\frac{3}{8}\right) = \frac{-5\sqrt{2255} - 12\sqrt{41}}{328}$$

$$\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta = \frac{\sqrt{2255}}{82} + \frac{11\sqrt{41}}{328}$$

Problem 7

$$2 \cos x \sin x + \sin x = 0$$

Solution

$$= \cancel{\sin x} 2 \cos x \sin x + \sin x = \sin x (2 \cos x + 1)$$

$$\sin x (2 \cos x + 1) = 0$$

$$\sin x = 0, \quad 2 \cos x + 1 = 0$$

$$\sin x = 0, \Rightarrow x = 2\pi n, \pi + 2\pi n$$

$$2 \cos x + 1, \Rightarrow x = \frac{2\pi}{3} + 2\pi n, \frac{4\pi}{3} + 2\pi n$$

$$\Rightarrow \pi n, \frac{2\pi}{3} + 2\pi n, \frac{4\pi}{3} + 2\pi n$$

Problem 8

$$\frac{-3 - i}{-1 + 2i}$$

$$\frac{-3 - i}{-1 + 2i}$$

Solution

$$= \frac{(-3(-1) + (-1)(2)) + (-1)(-1) - (-3)(2)i}{(-1)^2 + 2^2}$$

$$= \frac{1 + 7i}{5} = \frac{1}{5} + \frac{7}{5}i$$

Problem 9

$$(a) \quad c_1 = 30 \cos(163) + i (30 \sin(163))$$

$$(b) \quad c_2 = 8 \cos(211) + i (8 \sin(211))$$

$$(c) \quad \frac{30 \cos(163) + i (30 \sin(163))}{8 \cos(211) + i (8 \sin(163))} = 3.6680531 - 0.77966884i$$

$$\text{modulus} \approx 3.6680531$$

Argument

$$\text{d } \cancel{c_1 \div c_2} \quad \text{or } c_1 \div c_2 = 0.77966884i$$

$$\approx \underline{\underline{3.6680531 - 0.77966884i}}$$