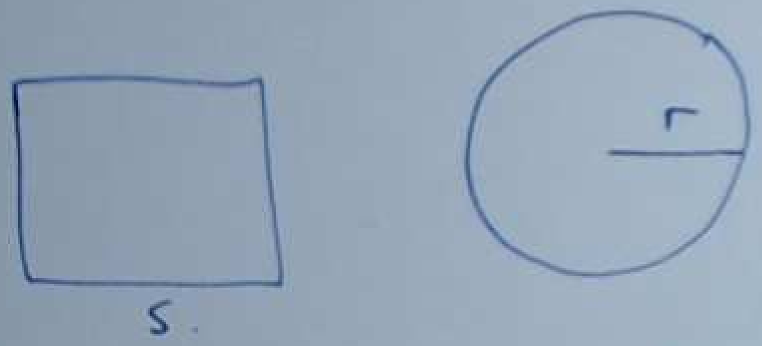
wire

380 in



← equal area

area s^2 πr^2

perimeter $4s$ $2\pi r$

pi π

3.1415...

↙ square

↘ circle

$P = x = 4s$

$\frac{x}{4} = s$

$\boxed{A = s^2 = \left(\frac{x}{4}\right)^2 = \frac{x^2}{16}}$

$P = 380 - x = 2\pi r$

$\frac{380 - x}{2\pi} = r$

$\boxed{A = \pi\left(\frac{380 - x}{2\pi}\right)^2}$

$C = 2\pi$

$A = \pi$

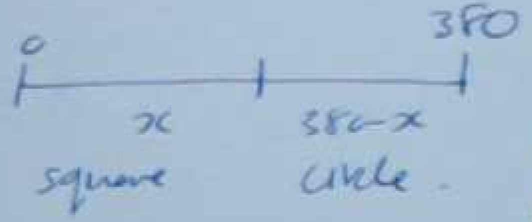
↓ scale $\times r$

$C = 2\pi r$

$A = \pi r^2$

2

area of square $\frac{x^2}{16} = \pi\left(\frac{380-x}{2\pi}\right)^2$ area of circle.



$$\frac{x^2}{16} = \cancel{\pi}\left(\frac{380^2 - 760x + x^2}{4\pi^{\cancel{2}}}\right)$$

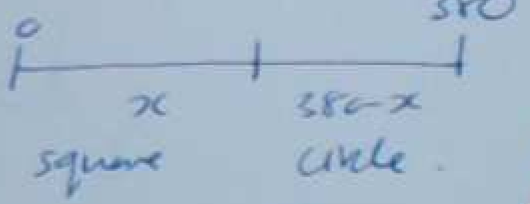
$$\frac{\cancel{4}\pi x^2}{\cancel{16}\ 4} = 380^2 - 760x + x^2$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\overset{a}{x^2\left[1 - \frac{\pi}{4}\right]} - \overset{b}{760}x + \overset{c}{380^2} = 0$$

$$x = \frac{760 \pm \sqrt{760^2 - 4 \times \left(1 - \frac{\pi}{4}\right) \times 380^2}}{2 \times \left(1 - \frac{\pi}{4}\right)}$$

area of square $\frac{x^2}{16} = \pi\left(\frac{380-x}{2\pi}\right)^2$ area of circle.



$$\frac{x^2}{16} = \cancel{\pi}\left(\frac{380^2 - 760x + x^2}{4\pi^{\cancel{2}}}\right)$$

$$\frac{\cancel{4}\pi x^2}{\cancel{16}\,4} = 380^2 - 760x + x^2$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\overset{a}{x^2\left[1 - \frac{\pi}{4}\right]} - \overset{b}{760x} + \overset{c}{380^2} = 0$$

$$x = \frac{760 \pm \sqrt{760^2 - 4\times\left(1-\frac{\pi}{4}\right)\times 380^2}}{2\times\left(1-\frac{\pi}{4}\right)}$$

$x = 201.5$ in.

3

circle

$2\pi r = x$

$r = \frac{x}{2\pi}$

$A = \pi r^2 = \pi \left(\frac{x}{2\pi}\right)^2$

square. $P = 380 - x = 4s$

$\frac{380-x}{4} = s$

$A = \left(\frac{380-x}{4}\right)^2 = \frac{(380-x)^2}{4^2}$

$$\cancel{\pi} \frac{x^2}{4\pi^{\cancel{2}}} = \frac{(380-x)^2}{16}$$

$$\frac{4x^2}{\pi} = (380-x)^2 = 380^2 - 760x + x^2$$

use formula $\longrightarrow$ $x^2\left(\frac{4}{\pi} - 1\right) + 760x - 380^2 = 0$

(4)

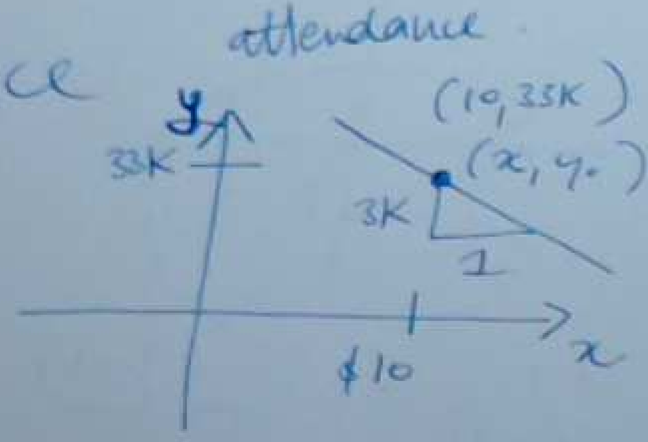
capacity 56000

average attendance at \$10 is 33000

ticket goes down by \$1 attendance rises by 3000

x price R amount of money

$R = x \times$ attendance



point slope formula for a line

$$y - y_0 = m(x - x_0)$$

attendance 33K −3000 10

slope $-\frac{3000}{1}$

attendance $y = 33000 - 3000(x - 10)$

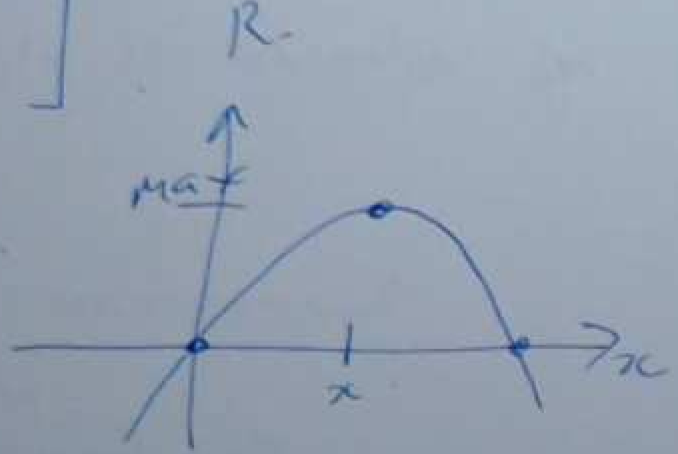
revenue $R = \underbrace{x}_{\text{price of ticket}} \times \text{attendance}$

$33000 - 3000x + 30{,}000$

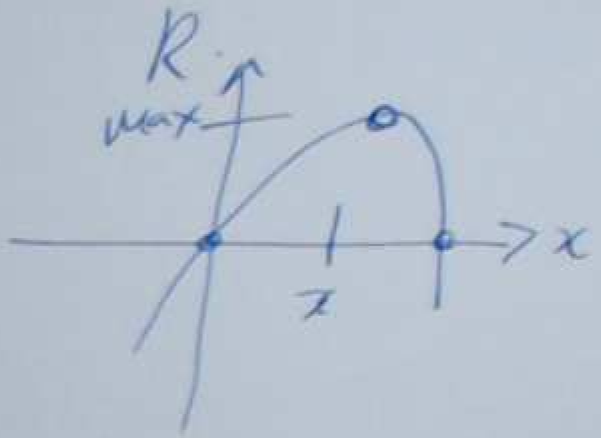
$$R = x(63{,}000 - 3000x)$$

$$= 3000[x(21 - x)]$$

$$= 3000(21x - x^2)$$



$R = 3000\,(\,x\,(21-x)\,)$



solve $R=0$: $3000\,\underbrace{x}_{x=0}\,\underbrace{(21-x)}_{x=21}=0$

\$21 = so expensive no one goes.

find max R: complete the square.

$21x - x^2$

$-\,(\,x^2 - 21x\,)$

$-\left(\left(x-\frac{21}{2}\right)^2 - \left(\frac{21}{2}\right)^2\right)$

$-\left(\,x^2 - 21x + \left(\frac{21}{2}\right)^2 - \left(\frac{21}{2}\right)^2\right)$

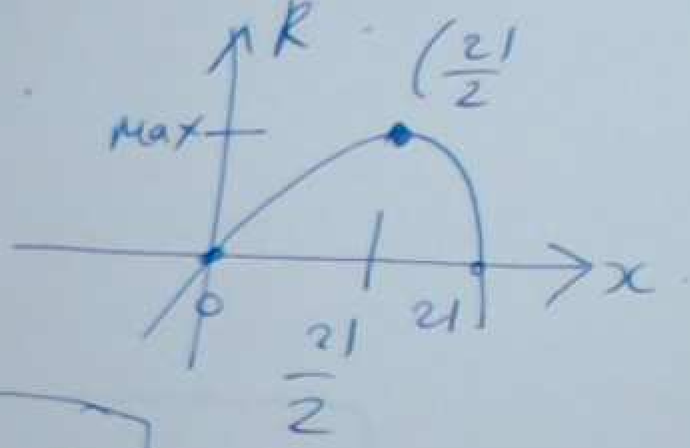
want

$(a+b)^2$

$(x+a)^2 + b$

$x^2 + 2ax + a^2 + b$

$$-3000\left(\left(x-\frac{21}{2}\right)^2-\left(\frac{21}{2}\right)^2\right)$$



$$R = 3000\left[\left(\frac{21}{2}\right)^2 - \underbrace{\left(x-\frac{21}{2}\right)^2}\right]$$

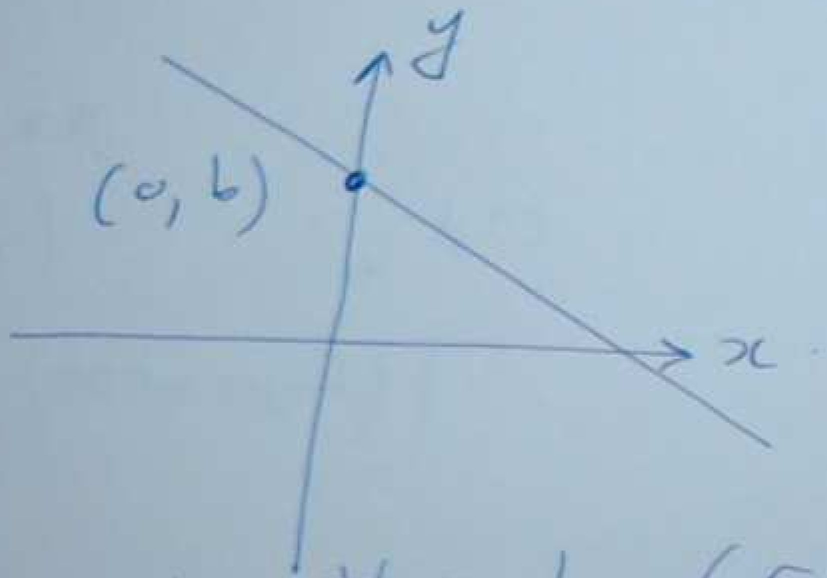
$$\boxed{x = \frac{21}{2} = \$10.5}$$

$$R\left(\frac{21}{2}\right) = 3000 \times \left(\frac{21}{2}\right)^2 = \boxed{\$33,0750}\ R$$

straight lines

$$y = mx + b$$

slope y-intercept



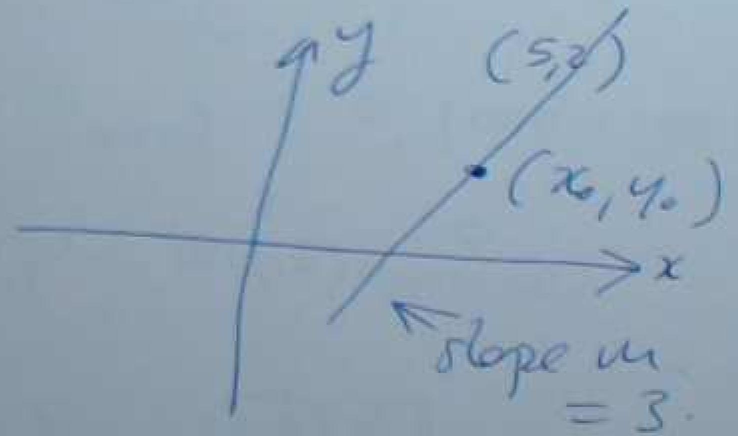
Q1 line with slope 3 passing through (5, 2)

point slope formula

$$y - \overset{2}{\underset{3}{y_0}} = \overset{3}{m}(x - \overset{5}{\underset{4}{x_0}})$$

$$y = mx - \underline{x_0 + y_0}$$

$$(x_0, y_0) = (5, 2)$$



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$$m = 3$$

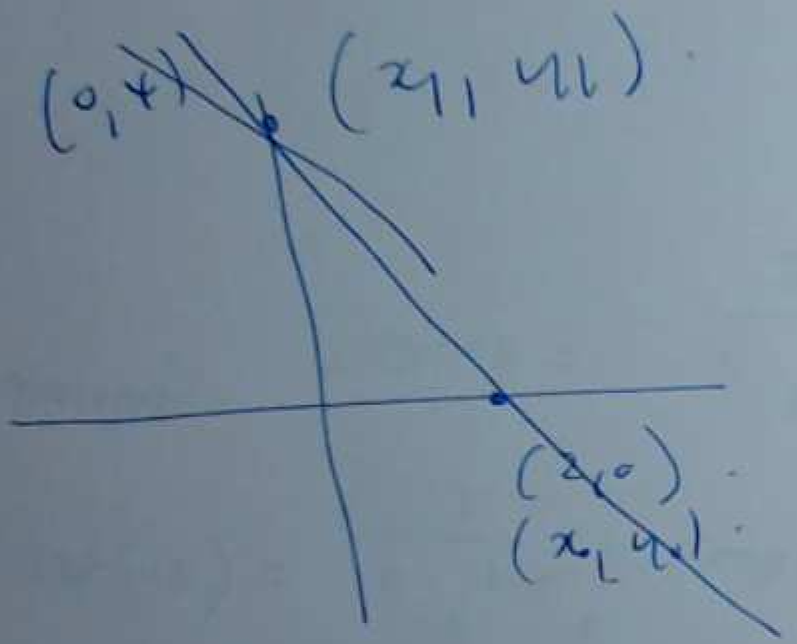
$$(x_0, y_0) = (5, 2)$$

$$y - y_0 = m(x - x)$$

$$\underset{+2}{y - 2} = 3(x - 5) \quad {}_{+2}$$

$$y = 3x - 15 + 2$$

$$y = 3x - 13$$



find equation of line.

$$y - \underset{0}{y_0} = \underset{-2}{m}(x - \underset{2}{x_0})$$

$$y = -2(x-2)$$

$$\boxed{y = -2x+4}$$

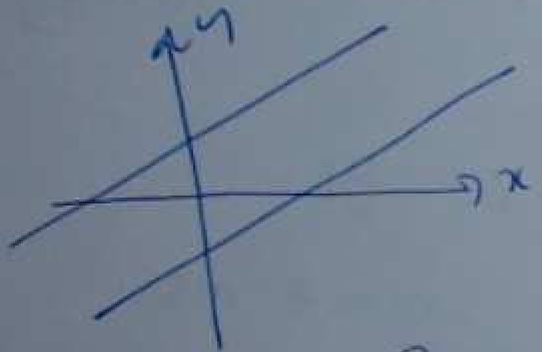
$$\frac{\text{diff in } y}{\text{diff in } x} = m = \text{slope}.$$

$$\frac{y_1 - y_0}{x_1 - x_0} = \frac{0-4}{2-0} = \frac{-4}{2} = -2 = m.$$

Q4 line parallel to $2x - 6y = 3$

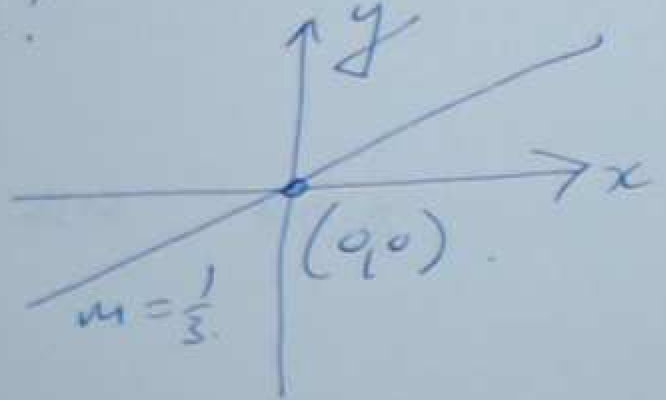
slope?

passing through $(0,0)$



parallel

$\Leftrightarrow$ same slope



$$2x - 6y = 3$$
$$+6y \quad +6y$$
$$2x = 3 + 6y$$
$$-3 \quad -3$$
$$2x - 3 = 6y$$
$$\tfrac{1}{3}x - \tfrac{1}{2} = y$$

slope $= \frac{1}{3}$

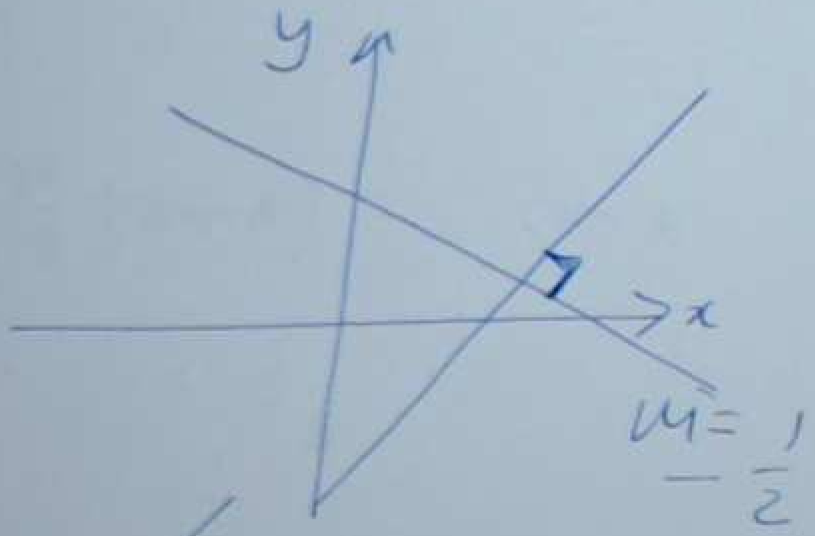
$$y - y_0 = m(x - x_0)$$
$$0 \quad \tfrac{1}{3} \quad 0$$
$$y = \frac{1}{3}x.$$

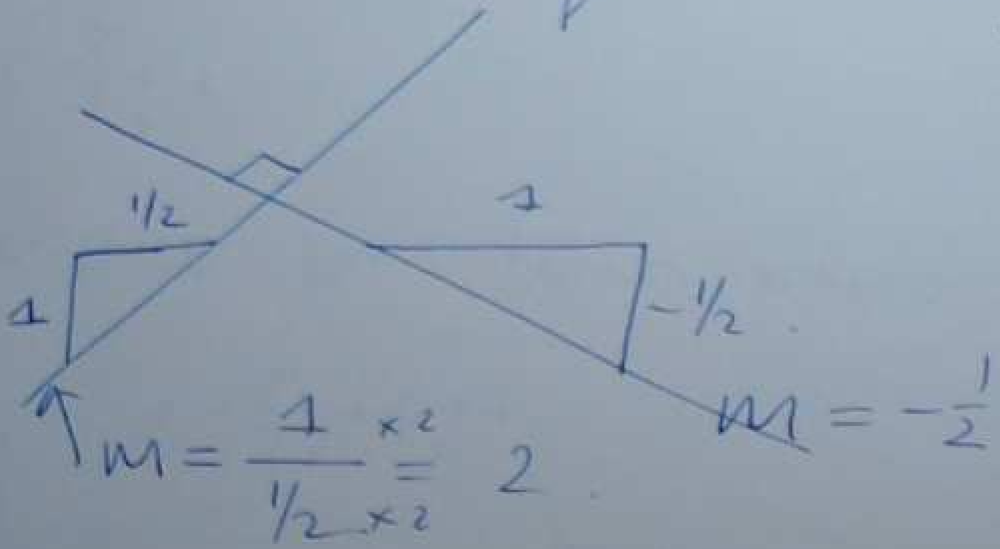
(12)

find the line perpendicular to $x+2y=3$
passing through $(0,0)$.

$$x + 2y = 3$$
$$-x \qquad\quad -x$$
$$2y = 3 - x$$
$$y = \frac{3}{2} - \frac{x}{2}$$
$$y = -\frac{1}{2}x + \frac{3}{2}$$

slope





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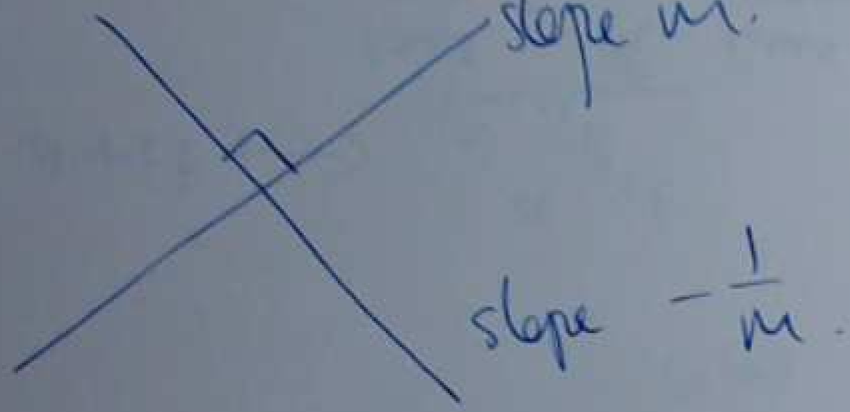

line $m = 2$

through $(0, 0)$.

point slope formula $y - y_0 = m(x - x_0)$.

$y - 0 = 2(x - 0)$ $y = 2x$.

Joseph Maher

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solving equations

14

Q5

$$4 - 3x = 8 - 6x$$

$$+3x \qquad +3x$$

$$4 = 8 - 3x$$

$$-8 \qquad -8$$

$$-4 = -3x$$

$$\frac{-4}{-3} = x = \frac{4}{3}$$

Joseph Maher

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(15)

Q6 $x^3 - x^2 = 0$

wrong way : $x^3 - x^2 = 0$

$+x^2 \quad +x^2$

$\frac{x^3}{x^2} = \frac{x^2}{x^2} \quad (x \neq 0)$

$x = 1$

better way

factor

$x^3 - x^2 = 0$

$\underbrace{x^2}_{x=0}\underbrace{(x-1)}_{x=1} = 0$

$\boxed{x = 0, 1}$

Joseph Maher

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Q8 $x^2 - 5x - 14 = 0$

1 14 7
1 1 2

try: $(x-7)(x+2) = 0$

$x^2 \underbrace{-7x+2x}_{-5x} - 14$

$(x-7)(x+2) = 0$

$\boxed{x = 7, -2}$

$x^2 - 5x - 13$

13
1

use quadratic formula

Joseph Maher

9. $3x^2 - 4x - 4 = 0$

ANSWER $\boxed{}$

10. $36x^3 + 18x^2 = 0$

ANSWER $\boxed{}$

11. $3\sqrt{x} + 2 = 0$

ANSWER $\boxed{}$

12. $4\sqrt[3]{x} - 8 = 0$

ANSWER $\boxed{}$

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2c

Q11

$$3\sqrt{x} + 2 = 0$$
$$-2 \qquad -2$$

$$\sqrt[3]{x} = x^{1/3}$$

$$\left(x^{1/3}\right)^3 = x^1$$

$$3\sqrt{x} = -2$$
$$\sqrt{x} = -\frac{2}{3} \leftarrow \text{no solutions}$$

Q12

$$4\sqrt[3]{x} - 8 = 0$$
$$+8 \qquad +8$$

$$\frac{4\sqrt[3]{x}}{4} = \frac{8}{4}$$

$$\left(\sqrt[3]{x}\right)^3 = (2)^3$$
$$x = 8$$

Joseph Maher

Q13

$$\sqrt{x} - x^2 = 0$$
$$+x^2 \qquad +x^2$$

$$(\sqrt{x})^2 = (x^2)^2$$

$$x = x^4$$

$$x^4 - x = 0$$

$$x(x^3 - 1) = 0$$ ✓ long division

$$x(x-1)(\text{quadratic})$$

$$x(x-1)(x^2+x+1)$$ ← no solutions

$$x = 0, 1$$

$$\begin{array}{r} x^2 + x + 1 \\ x - 1 \;\big)\; x^3 - 1 \\ x^3 - x^2 \\ \hline x^2 - 1 \\ x^2 - x \\ \hline x - 1 \end{array}$$