QT Simultaneous Equations

Solve the simultaneous equations

1. $2y - 3x = 6$
     $2x + 2y = 1$ (3 marks)

$$-3x + 2y = 6$$
$$2x + 2y = 1 \quad -$$
$$\overline{}$$
$$-5x \qquad = 5$$
$$x \qquad = -1$$

Substitute

$$2x + 2y = 1$$
$$2(-1) + 2y = 1$$
$$-2 + 2y = 1$$
$$2y = 3$$
$$y = 1.5$$

$$x = -1, \ y = 1.5.$$

2. $2x + 3y = -3 \qquad +3$
     $3x - 2y = 28 \qquad +2.$ (3 marks)

$$6x + 9y = -9$$
$$6x - 4y = 56 \quad -$$
$$\overline{}$$
$$13y = -65$$
$$y = -5.$$

Substitute

$$2x + 3y = -3$$
$$2x + 3(-5) = -3$$
$$2x - 5 = -3$$
$$2x = 12$$
$$x = 6$$

$$x = 6, \ y = -5.$$

QT Simultaneous Equations

3.   A rectangle has a perimeter of 22m. The width is 3m less than the length. Find the length and width.   (3 marks)

$w = L - 3$

Perimeter $= 2L + 2w$

$2L + 2w = 22$

$2L + 2(L-3) = 22$

$2L + 2L - 6 = 22$

$4L - 6 = 22$

$4L = 28$

$L = 7$

$w = L - 3$

$w = 7 - 3$

$w = 4$

∴ length $= 7m$, width $= 4m$.

4.   A farmer has sheep and ostriches on his farm. He counts 92 heads and 194 legs. How many sheep and ostriches does he have?   (4 marks)

$S + O = 92$ $(\times 2)$

$4S + 2O = 194$

$4S + 2O = 194$

$2S + 2O = 184$
_____

$2S = 10$

$S = 5$

$S + O = 92$

$S + O = 92$

$O = 87$

5 sheep

87 ostriches.

QT Simultaneous Equations

5.   3x - y = -4 $\times$ L
       2x - 3y = 9 $\times$ 3   (4 marks)

$$6x - 6y = -8$$
$$6x - 9y = 27$$ —
$$\overline{\hspace{2cm}}$$
$$3y = -35$$
$$y = -5$$

Solve it

$$3x - y = -4$$
$$3x - (-5) = -4$$
$$3x + 5 = -4$$
$$3x = -9$$
$$x = -3$$

$$x = -3, \quad y = -5.$$

6.   3x = 9 + y
       x + 5y = 5   (4 marks)

$$3x - y = 9$$
$$x + 5y = 5 \quad \times 3$$

$$3x - y = 9$$
$$3x + 15y = 15$$ —
$$\overline{\hspace{2cm}}$$
$$-16y = 6$$
$$y = -\frac{6}{16}$$
$$y = -\frac{3}{8}$$
$$\text{or} \; -0.375$$

Solve it

$$3x - y = 9$$
$$3x - \left(-\frac{3}{8}\right) = 9$$
$$3x + \frac{1}{8} = 9$$
$$3x = \frac{69}{8}$$
$$x = \frac{23}{8}$$
$$\text{or} \; 2.875.$$

$$x = -\frac{3}{8} \quad y = \frac{23}{8}$$

QT Simultaneous Equations

7.   Three apples and two bananas cost 75p.
Four apples and one banana cost 80p.
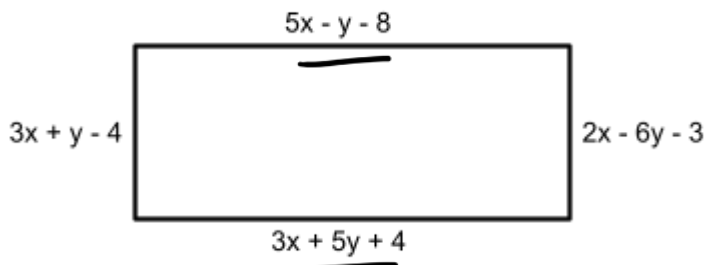Find the price of one apple and one banana.   (4 marks)

$3A + 2B = 75$
$4A + 1B = 80$ ×2

$3A + 2B = 75$ —
$8A + 2B = 160$
_____
$-5A \quad\quad = -85$

$A = 17p$

SUBSTITUTE

$3A + 2B = 75$
$3(17) + 2B = 75$
$51 + 2B = 75$
$2B = 24$
$B = 12p$

8. The dimensions, in centimetres, of this rectangle are shown as algebraic expressions.
Work out the length and height of the rectangle.   (6 marks)

```
                    5x - y - 8
        ┌─────────────────────────────┐
3x+y-4  │                             │  2x - 6y - 3
        └─────────────────────────────┘
                    3x + 5y + 4
```

$5x - y - 8 = 3x + 5y + 4$
$2x - 6y = 12$
$x - 3y = 6$

$3x + y - 4 = 2x - 6y - 3$
$x + 7y = 1$

$x + 7y = 1$ —
$x - 3y = 6$
_____
$10y = -5$
$y = -0.5$

SUBSTITUTE

$x + 7y = 1$
$x + 7(-0.5) = 1$
$x = 4.5$

Length $5x - y - 8$
$5(4.5) - (-0.5) - 8 = 15cm$

Width $3x + y = 4$
$3(4.5) + (-0.5) = 4 = 9cm$

QT Simultaneous Equations

9.   3 teas and 2 coffees have a total cost of £7.80.
5 teas and 4 coffees have a total cost of £14.20.
Work out the cost of one tea and one coffee.   (4 marks)

(×2) $3T + 2C = 780$

$5T + 4C = 1420$

$6T + 4C = 1560$ —
$5T + 4C = 1420$
_____

$1T = 140$

Tea $= £1.40$

Substitute

$3T + 2C = 780$

$3(140) + 2C = 780$

$420 + 2C = 780$

$2C = 360$

$1C = 180$

Coffee $= £1.80$

10.   Solve the simultaneous equations where p is a constant. Give your answer in terms
of p in their simplest form.

$2x + 3y = 5p$

$y = 2x + p$ (4 marks)

$2x + 3y = 5p$ +
$-2x + y = p$
_____

$4y = 6p$

$y = \frac{6}{4}p$

$y = 1.5p$

Substitute

$y = 2x + p$

$1.5p = 2x + p$

$0.5p = 2x$

$\frac{0.5p}{2} = x$

$x = 0.25p$