

ALGEBRA (Q 2 & 3, PAPER 1)

LESSON NO. 6: LITERAL EQUATIONS & SUBSTITUTION

2007

2 (b) (i) Find the value of $\frac{x+3y+5}{2x+2y}$ when $x = \frac{5}{2}$ and $y = \frac{1}{3}$.

SOLUTION

$$\begin{aligned}\frac{x+3y+5}{2x+2y} &= \frac{(\frac{5}{2})+3(\frac{1}{3})+5}{2(\frac{5}{2})+2(\frac{1}{3})} = \frac{\frac{5}{2}+1+5}{5+\frac{2}{3}} \\ &= \frac{\frac{17}{2}}{\frac{17}{3}} = \frac{17}{2} \times \frac{3}{17} = \frac{3}{2}\end{aligned}$$

2006

3 (a) Find the value of $\frac{ab-c}{2}$ when $a = 3$, $b = \frac{2}{3}$ and $c = 1$.

SOLUTION

3 (a)

$$\frac{ab-c}{2} = \frac{(3)(\frac{2}{3})-1}{2} = \frac{2-1}{2} = \frac{1}{2}$$

2005

2 (a) Find the value of $x^2 - 5xy$ when $x = 3$ and $y = -2$.

3 (a) Given that $ax + b = c$, express x in terms of a , b and c , where $a \neq 0$.

SOLUTION

2 (a)

$$x^2 - 5xy = (3)^2 - 5(3)(-2) = 9 + 30 = 39$$

3 (a)

$ax + b = c \Rightarrow ax = c - b$ [Isolate the ax term by moving the b term across.]

$$\Rightarrow x = \frac{c-b}{a} \text{ [Isolate the } x \text{ term by dividing both sides by } a\text{.]}$$

2004

2 (a) Find the value of $3(2p - q)$ when $p = -4$ and $q = 5$.

SOLUTION

2 (a)

$$3(2p - q) = 3(2(-4) - 5) = 3(-8 - 5) = 3(-13) = -39$$

2003

2 (a) Given that $3x - 2y = 4$, find the value of y when $x = -2$.

SOLUTION

2 (a)

$$3x - 2y = 4 \Rightarrow 3(-2) - 2y = 4$$

$$\Rightarrow -6 - 2y = 4 \Rightarrow -6 - 4 = 2y$$

$$\Rightarrow -10 = 2y \Rightarrow y = -5$$

2002

2 (c) (i) Express b in terms of a and c where $\frac{8a - 5b}{b} = c$.

(ii) Hence, or otherwise, evaluate b when $a = 2^{\frac{5}{2}}$ and $c = 3^3$.

SOLUTION

2 (c) (i)

$$\frac{8a - 5b}{b} = c \text{ [Multiply both sides by } b\text{.]}$$

$$\Rightarrow 8a - 5b = bc \text{ [Bring the } b \text{ terms to the right.]}$$

$$\Rightarrow 8a = bc + 5b \text{ [Factorise the right hand side by taking out } b \text{ in common.]}$$

$$\Rightarrow 8a = b(c + 5) \text{ [Divide both sides by } (c + 5)\text{.]}$$

$$\Rightarrow \frac{8a}{(c + 5)} = b$$

2 (c) (ii)

$$\Rightarrow b = \frac{8a}{(c + 5)} \Rightarrow b = \frac{8(2^{\frac{5}{2}})}{(3^3 + 5)} \text{ [NOTE: } 3^3 = 27\text{]}$$

$$\Rightarrow b = \frac{8(2^{\frac{5}{2}})}{(27 + 5)} = \frac{8(2^{\frac{5}{2}})}{32} \text{ [Change each number into a power of 2.]}$$

$$\Rightarrow b = \frac{(2^3)(2^{\frac{5}{2}})}{2^5} \text{ [Use the power rules]}$$

$$\Rightarrow b = \frac{2^{\frac{11}{2}}}{2^5} = 2^{\frac{1}{2}} = \sqrt{2}$$

POWER RULES

1. $a^m \times a^n = a^{m+n}$ **Ex.** $x^3 \times x^2 = x^5$

2. $\frac{a^m}{a^n} = a^{m-n}$ **Ex.** $\frac{x^5}{x^3} = x^2$

6. $\sqrt{a} = a^{\frac{1}{2}}$ **Ex.** $\sqrt{9} = 9^{\frac{1}{2}} = 3$

2001

3 (a) Given that $u^2 + 2as = v^2$, calculate the value of a when $u = 10$, $s = 30$ and $v = 20$.

SOLUTION

3 (a)

$$u^2 + 2as = v^2 \Rightarrow (10)^2 + 2a(30) = 20^2$$

$$\Rightarrow 100 + 60a = 400 \Rightarrow 60a = 300$$

$$\Rightarrow a = \frac{300}{60} \Rightarrow a = 5$$

2000

2 (a) Find the value of $5x - 3y$ when $x = \frac{5}{2}$ and $y = \frac{2}{3}$.

3 (a) Express p in terms of t and k when

$$tp - k = 7k, \quad t \neq 0.$$

SOLUTION

2 (a)

$$5x - 3y = 5\left(\frac{5}{2}\right) - 3\left(\frac{2}{3}\right) = \frac{25}{2} - 2 = \frac{21}{2}$$

3 (a)

$$tp - k = 7k \Rightarrow tp = 7k + k \quad \text{[Bring the } k \text{ terms to the right and add them together.]}$$

$$\Rightarrow tp = 8k \quad \text{[Divide both sides by } t \text{.]}$$

$$\Rightarrow p = \frac{8k}{t}$$

1999

3 (a) Express p in terms of q and r when

$$\frac{p - 3r}{q} = 5, \quad q \neq 0.$$

SOLUTION

3 (a)

$$\frac{p - 3r}{q} = 5 \quad \text{[Multiply both sides by } q \text{.]}$$

$$\Rightarrow p - 3r = 5q$$

$$\Rightarrow p = 5q + 3r$$

1998

2 (b) Find the value of

$$\frac{a-b+1}{a+b+1}$$

when $a = \frac{1}{8}$ and $b = 2$.

3 (a) Express p in terms of q and t when

$$q + \frac{p}{5t} = 3, t \neq 0.$$

SOLUTION

2 (b)

$$\frac{a-b+1}{a+b+1} = \frac{(\frac{1}{8}) - (2) + 1}{(\frac{1}{8}) + (2) + 1} = \frac{\frac{1}{8} - \frac{16}{8} + \frac{8}{8}}{\frac{1}{8} + \frac{16}{8} + \frac{8}{8}} = \frac{-\frac{7}{8}}{\frac{25}{8}} = -\frac{7}{8} \times \frac{8}{25} = -\frac{7}{25}$$

3 (a)

$$q + \frac{p}{5t} = 3 \text{ [Multiply each term by } 5t\text{.]}$$

$$\Rightarrow 5tq + p = 15t$$

$$\Rightarrow p = 15t - 5tq$$

1997

3 (a) Express p in terms of q and t when

$$2p - q = 3(p - t).$$

SOLUTION

3 (a)

$$2p - q = 3(p - t) \text{ [Multiply out the bracket.]}$$

$$\Rightarrow 2p - q = 3p - 3t \text{ [Bring the } p \text{ terms to one side and the other terms to the other side.]}$$

$$\Rightarrow 3t - q = 3p - 2p \text{ [Add the } p \text{ terms.]}$$

$$\Rightarrow 3t - q = p$$

1996

3 (a) Express q in terms of p and t when

$$2(p - 3q) = t.$$

SOLUTION

3 (a)

$$2(p - 3q) = t \text{ [Multiply out the bracket.]}$$

$$\Rightarrow 2p - 6q = t \text{ [Isolate the } q \text{ term.]}$$

$$\Rightarrow 2p - t = 6q \text{ [Divide both sides by 6.]}$$

$$\Rightarrow \frac{2p - t}{6} = q$$