education equals

Topic: Linear Algebra and Solving Equations

Time: 45 mins Marks: /45 marks
No calculator allowed

Question One: [2, 3, 2, 3, 3, 4 : 17 marks]

a) There are 365 days in a year and 366 days in a leap year. There are x number of leap years in a 17 year period and 6208 days in total.

i) Write an equation in terms of x for the total number of days in this 17 year period.

ii) Solve your equation to calculate the number of leap years.

b) Troye is 4 years younger than Sage and Sage is 17 years older than Tyde. In 10 years time Troye will be twice Tyde's age.

i) If Tyde's age today is y, write an equation in terms of y for Tyde's age in 10 years time.

ii) Solve your equation to calculate Tyde, Troye and Sage's ages today.

c) Katy works 8 hours a week. Taylor works 20% less than Miley and Miley works 10 hours more than Beyoncé.

i) Let the number of hours that Beyoncé works be B and write an expression for the total number of hours that the ladies all work.

In total these ladies work 54 hours a week.

ii) Hence or otherwise, calculate the number of hours each lady works per week.

Question Two: [2, 2, 2, 2: 8 marks]

Dr Sebastian has developed a new medication to help premature babies. The dosage of vaccination is calculated based on the baby's weight.

The formula for the dosage is, half the baby's weight subtracted from 30, subtract three times the weight.

a) Write the formula for the dosage, D based on weight, w.

b) What is the dosage required for a 3kg baby?

c) What is weight of a baby requiring a 23mL dosage?

This formula only makes sense up to a certain weight.

d) Explain why the formula only makes sense up to this weight.

Question Three: [4, 4, 5: 13 marks]

Use algebraic techniques to solve the following simultaneous equations.

a) $2x + 3y = 0$

$x - 7y = 34$

b) $k = 5j + 10$

$3j = 20 - k$

c) $\begin{bmatrix} 10 & -2 \\ 4 & 1 \end{bmatrix} \begin{bmatrix} m \\ n \end{bmatrix} = \begin{bmatrix} 13 \\ -2 \end{bmatrix}$

Question Four: [7 marks]

Tickets to the One Direction concert went on sale. There were two different classes of tickets, general admission and premium.

As soon as the tickets went on sale Hailey and Jennifer tried to buy as many tickets as they could so that they could go with all of their friends. Neither of them could buy enough premium tickets so Hailey bought 2 premium tickets and 4 general admission and she spent $880. Jennifer got 3 of each and it cost her $960.

What is the price of each class of ticket? Show algebraic working to support your answer.

education equals

Topic: Linear Algebra and Solving Equations
SOLUTIONS
Time: 45 mins Marks: /45 marks
No calculator allowed

Question One: [2, 3, 2, 3, 3, 4 : 17 marks]

a) There are 365 days in a year and 366 days in a leap year. There are x number of leap years in a 17 year period and 6208 days in total.

i) Write an equation in terms of x for the total number of days in this 17 year period.

$x(366) + (17 - x)365 = 6208$ ✓ ✓

ii) Solve your equation to calculate the number of leap years.

$366x + 6205 + 365x = 6208$ ✓

$x = 3$ ✓

$\therefore 3$ *leap years* ✓

b) Troye is 4 years younger than Sage and Sage is 17 years older than Tyde. In 10 years time Troye will be twice Tyde's age.

i) If Tyde's age today is y, write an equation in terms of y for Tyde's age in 10 years time.

	Now	In 10 years
Troye→	$y + 13$	$y + 23$
Sage→	$y + 17$	
Tyde→	y	$y + 10$

$2(y + 10) = y + 23$ ✓ ✓

ii) Solve you equation to calculate Tyde, Troye and Sage's ages today.

$2y + 20 = y + 23$

$y = 3$

Tyde is 3 *Troye is* 16 *and Sage is* 20 ✓ ✓ ✓

c) Katy works 8 hours a week. Taylor works 20% less than Miley and Miley works 10 hours more than Beyoncé.

i) Let the number of hours that Beyoncé works be B and write an expression for the total number of hours that the ladies all work.

$B: B$

$T: 0.8(B + 10)$

$M: B + 10$

$K: 8$ ✓

$Total = B + 0.8B + 8 + B + 10 + 8$ ✓

$= 2.8B + 26$ ✓

In total these ladies work 54 hours a week.

ii) Hence or otherwise, calculate the number of hours each lady works per week.

$54 = 2.8B + 26$

$28 = 2.8B$

$10 = B$

Beyonce works 10 *hours* ✓

Taylor works 16 *hours* ✓

Miley works 20 *hours* ✓

and

Katy works 8 *hours* ✓

Question Two: [2, 2, 2, 2: 8 marks]

Dr Sebastian has developed a new medication to help premature babies. The dosage of vaccination is calculated based on the baby's weight.

The formula for the dosage is, half the baby's weight subtracted from 30, subtract three times the weight.

a) Write the formula for the dosage, D based on weight, w.

$D = \left(30 - \frac{w}{2}\right) - 3w$ ✓ ✓

b) What is the dosage required for a 3kg baby?

$D = (30 - 1.5) - 9$ ✓

$= 19.5mL$ ✓

c) What is weight of a baby requiring a 23mL dosage?

$23 = 30 - \frac{w}{2} - 3w$

$-7 = -3.5w$ ✓

$\frac{-7}{-3.5} = w$

$weight = 2kg$ ✓

This formula only makes sense up to a certain weight.

d) Explain why the formula only makes sense up to this weight.

$D = 30 - 3.5w$ ✓

After a certain weight the dosage will be negative. Any weight less than $\frac{30}{3.5}$ will not make sense as it will result in a negative dosage. ✓

Question Three: [4, 4, 5: 13 marks]

Use algebraic techniques to solve the following simultaneous equations.

a) $2x + 3y = 0$ *equation 1*

$x - 7y = 34 \times 2$

$2x - 14y = 68$ *equation 2* ✓

equation 1 − equation 2

$17y = -68$ ✓

$y = -4$ ✓

$x = 34 + (7 \times -4)$

$x = 6$ ✓

b) $k = 5j + 10$

$3j = 20 - k$

$3j = 20 - (5j + 10)$ ✓

$3j = 20 - 5j - 10$

$8j = 10$ ✓

$j = 1.25$ ✓

$k = 5(1.25) + 10$

$k = 16.25$ ✓

c) $\begin{bmatrix} 10 & -2 \\ 4 & 1 \end{bmatrix} \begin{bmatrix} m \\ n \end{bmatrix} = \begin{bmatrix} 13 \\ -2 \end{bmatrix}$

$10m - 2n = 13$ *equation 1* ✓

$4m + n = -2 \times 2$ ✓

$8m + 2n = -4$ *equation 2*

equation 1 + equation 2

$18m = 9$ ✓

$m = 0.5$ ✓

$2 + n = -2$

$n = -4$ ✓

Question Four: [7 marks]

Tickets to the One Direction concert went on sale. There were two different classes of tickets, general admission and premium.

As soon as the tickets went on sale Hailey and Jennifer tried to buy as many tickets as they could so that they could go with all of their friends. Neither of them could buy enough premium tickets so Hailey bought 2 premium tickets and 4 general admission and she spent $880. Jennifer got 3 of each and it cost her $960.

What is the price of each class of ticket? Show algebraic working to support your answer.

$2p + 4g = 880$ ✓

$3p + 3g = 960$ ✓

$6p + 12p = 2640$ ✓

$-(6p + 6g = 1920)$

$6g = 720$ ✓

$g = 120$ ✓

$2p + 480 = 880$

$p = 200$ ✓

premium tickets cost $200

general tickets cost $120 ✓