Substitution Exam Practice

Q1. Given that a = 7 and b = 5, work out the value of $3a + 2b$

$$3(7) + 2(5)$$
$$= 21 + 10$$
$$= 31$$

Answer:_____31_____

(2 marks)

Q2. Given that a = -3 and b = -10, work out the value of $4a - 7b$

$$4(-3) - 7(-10)$$
$$= -12 + 70$$
$$= 58$$

Answer:_____58_____

(2 marks)

Q3. Given that a = 7, b = ‑1 and c = 8, work out the value of $3a^2 + bc$

$$3(7^2) + (-1)(8)$$
$$= 3 \times 49 - 8$$
$$= 147 - 8$$
$$= 139$$

Answer: _____139_____

(2 marks)

Q4. Here is a formula: $M = \sqrt{2d} + 4e$.
Work out the value of M if d = 8, e = ‑1

$$M = \sqrt{2 \times 8} + 4(-1)$$
$$= \sqrt{16} - 4$$
$$= 4 - 4$$
$$= 0$$

Answer: _____0_____

(2 marks)

Q5. Here is a formula: $F = \frac{4a+b}{3b}$.

Work out the value of F if a = -2, b = 12 simplifying your answer fully.

$$F = \frac{4(-2)+12}{3 \times 12}$$

$$= \frac{-8+12}{36}$$

$$= \frac{4}{36}$$

$$= \frac{1}{9}$$

Answer: $\frac{1}{9}$

(2 marks)

Q6. Here is a formula: $R = 3p + (q - r)^2$

Work out the value of R if p = 2, q = 12, and r = 20

$$R = 3(2) + (12-20)^2$$

$$= 6 + (-8)^2$$

$$= 6 + 64$$

$$= 70$$

Answer: 70

(2 marks)

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Q7. Given the formula $F = \frac{a+2}{b}$, suggest two values for a and b so that the value of F will be greater 4 and less than 7.

eg. $a = 22, b = 4$

$\Rightarrow F = \frac{22+2}{4}$

$= \frac{24}{4}$

$= 6,$

$4 < 6 < 7$

Answer: eg $a = 22, b = 4$

(2 marks)

Q8. Given that a = ½ and b = ¾, work out the value of $A = \frac{3(a+b)^2}{6a+6b}$

$A = \frac{3\left(\frac{1}{2}+\frac{3}{4}\right)^2}{6\left(\frac{1}{2}\right)+6\left(\frac{3}{4}\right)}$

$= \frac{3\left(\frac{5}{4}\right)^2}{3+\frac{9}{2}}$

$= \frac{3\left(\frac{25}{16}\right)}{\frac{15}{2}}$

$= \frac{75}{16} \div \frac{15}{2}$

$= \frac{150}{240}$

Answer: $\frac{5}{8}$

(2 marks)

Q9. Given that $u = 2\pi$ and $v = \pi$, work out, and simplify, the value of B where $B = u^2 + 4v - uv$. Leave your answer in terms of π.

$$B = (2\pi)^2 + 4\pi - (2\pi)\pi$$

$$= 4\pi^2 + 4\pi - 2\pi^2$$

$$= 2\pi^2 + 4\pi$$

Answer: $2\pi^2 + 4\pi$

(2 marks)

Q10. Given that c = 0.1, d = 0.3, and e = ⁻0.4, find the value of H which has formula, $H = \dfrac{1000}{\frac{c}{d} + \frac{e}{d}}$

$$H = \frac{1000}{\dfrac{0.1}{0.3} - \dfrac{0.4}{0.3}}$$

$$= \frac{1000}{\dfrac{1}{3} - \dfrac{4}{3}}$$

$$= \frac{1000}{-\dfrac{3}{3}}$$

$$= \frac{1000}{-1}$$

Answer: -1000

(2 marks)

Q11. Here is a formula: $S = ut + \frac{1}{2}at^2$

Work out the value of S if u = 20, t = 4, and a = -9.8

$$S = 20(4) + \frac{1}{2}(-9.8)4^2$$
$$= 80 - 4.9(16)$$
$$= 80 - 78.4$$
$$= 1.6$$

Answer: 1.6

(2 marks)

Applied Mixed Practice Problems

Q12. Here is a formula: $F = \sqrt{a - 2b}$

Joe wishes to substitute two sets of numbers into the formula:

Set 1:   **Set 2:**
a = 5, b = 3   a = 3, b = -8

Which of these sets is unsuitable for him to substitute? Explain your reasoning.

Set 1: a - 2b would be 5 - 2(3) = -1

and $\sqrt{-1}$ is not a real number.

Answer: Set A

(2 marks)

Q13. Here is a formula to convert between temperatures measured in °C and °F: $F = 32 + \frac{9}{5}C$

a) Use the formula to convert 50 °F to °C

$$50 = 32 + \frac{9}{5}C$$

$$18 = \frac{9}{5}C$$

$$90 = 9C$$
$$C = 10$$

Answer: __10 °C__

(2 marks)

b) Use the formula to convert 20 °C to °F

$$F = 32 + \frac{9}{5} \times 20$$

$$= 32 + 36$$

$$= 68$$

Answer: __68 °F__

(1 mark)

Q14. Here is a formula on a spreadsheet: $T = b^2 - 1$.
Mike will use it to enter different numbers for the value of b. He claims that if he only enters numbers such that b > 0, he will never get any negative results from the formula.
Do you agree? You must justify your reasoning.

Disagree: take for example, $b = \frac{1}{2}$,

$$\Rightarrow b^2 - 1 \text{ is } \left(\frac{1}{2}\right)^2 - 1$$

$$= \frac{1}{4} - 1$$
$$= -\frac{3}{4} < 0$$

(. In general $b^2 - 1 < 0$
for any b such that $0 < b < 1$)

Answer: __Disagree__

(2 marks)

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Q15. At a company, staff are put into different bands according to experience. The minimum sales target per month is shown below:

Band:	Items sold: (100's)
A	5
B	7
C	8

The monthly pay P (£) for sales staff is worked out using the formula:

$$P = 1100 - 2.5(M - N)$$

where N = no. sales made and M = the minimum target no. of sales.

(i) Gary is in band B and sells 750 items. Work out his monthly pay.

$$P = 1100 - 2.5(700 - 750)$$
$$= 1100 - 2.5(-50)$$
$$= 1100 + 125$$
$$= 1225$$

Answer: £1225

(2 marks)

(ii) Mary sells 475 items. Work out which of the bands, if any, she could be in and still earn more than £1000. Show all your working out.

Band Ⓐ:
$$P = 1100 - 2.5(500 - 475)$$
$$P = 1100 - 2.5(25)$$
$$P = 1100 - 62.5$$
$$P = £1037.5$$

so Band A would be the only Band to earn > £1000

(Band B: P = 537.5 and
Band C: P = 287.5)

Answer: A only

(2 marks)

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