UNIVERSITY OF SASKATCHEWAN
Department of Mathematics & Statistics
Mathematics 101.3 Solutions to Practice Quiz #1

Early October, 1999 Time:50 minutes Instructor: *Doug MacLean*

CLOSED BOOK — NO CALCULATORS PERMITTED
Each question is worth 4%
The possible answers to all questions are the digits in the **ANSWER SET:**

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4 (F) 5 (G) 6 (H) 7 (I) 8 (J) 9

If $\frac{7}{12} - \frac{3}{5}$ is written in its simplest form as $\frac{-a}{10b+c}$, where a, b, and c are digits, then

Solution: $\frac{7}{12} - \frac{3}{5} = \frac{7}{12}\frac{5}{5} - \frac{3}{5}\frac{12}{12} = \frac{35-36}{60} = \frac{-1}{60}$

(1) $a = 1$ **(2)** $b = 6$ **(3)** $c = 0$

$x^2 + 8x + 20$ is to be written in the form $a(x+b)^2 + c$ by completing squares. We must have:

Solution: $x^2 + 8x + 20 = x^2 + 2(4)x + 4^2 - 4^2 + 20 = (1)(x+4)^2 + 4$

(4) $a = 1$ **(5)** $b = 4$ **(6)** $c = 4$

$3x^2 + 12x + 4$ is to be written in the form $a(x+b)^2 - c$ by completing squares. We must have:

Solution: $3x^2 + 12x + 4 = 3\left(x^2 + 4x + \frac{4}{3}\right) = 3\left(x^2 + 2(2)4x + 2^2 - 2^2 + \frac{4}{3}\right) =$

$3\left((x + 2^2(2) - 4 + \frac{4}{3}\right) = 3\left((x + 2^2(2) - \frac{12}{3} + \frac{4}{3}\right) = 3\left((x + 2^2(2) - \frac{8}{3}\right) =$

$3(x+2)^2 - 3\frac{8}{3} = 3(x+2)^2 - 8$

(7) $a = 3$ **(8)** $b = 2$ **(9)** $c = 8$

(10) If $-a$ is the slope of the line through the points $(5,-3)$ and $(-1,3)$, then a is:

Solution: $-a = \frac{3-(-3)}{-1-5} = \frac{6}{-6} = -1$, so $a = 1$

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(11) Let $f(x) = \frac{x^3}{(x+3)^3}$. Find **Correction:** $-f(-2)$

Solution: $-f(-2) = -\frac{(-2)^3}{((-2)+3)^3} = -\frac{-8}{1} = 8$

The roots of $x^2 - 8x + 16 = 0$ in their simplest form are $\frac{A \pm B\sqrt{C}}{D}$. We must have:

Solution: The roots are $\frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(16)}}{2(1)} = \frac{8 \pm \sqrt{64-64}}{2} = \frac{8 \pm \sqrt{0}}{2}$

(12) $A = 8$ **(13)** $B = 1$ **(14)** $C = 0$ **(15)** $D = 2$

The polynomial $3x^4 + x^3 - 3x^2 - x$ can be factored in the form $x(x-a)(x+b)(cx+d)$, where a, b, c, and d are digits. Their values are:

Solution: $p(x) = 3x^4 + x^3 - 3x^2 - x = x(3x^3 + x^2 - 3x - 1)$. The only possible integer roots of $p(x)$ are -1 and 1. It is easily computed that both numbers are roots of $p(x)$, so we have $x+1$ and $x-1$ are factors of $p(x)$. Dividing them both into $3x^3 + x^2 - 3x - 1$, we find that $3x+1$ is th eremaining factor. Thus $p(x) = x(x-1)(x+1)(3x+1)$

(16) $a = 1$ **(17)** $b = 1$ **(18)** $c = 3$ **(19)** $d = 1$

$\frac{4-2\sqrt{2}}{2-\sqrt{2}}$ can be simplified to the expression $a - b\sqrt{c}$, where a, b, and$c$ are digits. Their values are:

Solution: Use conjugates: $\frac{4-2\sqrt{2}}{2-\sqrt{2}}\left(\frac{2+\sqrt{2}}{2+\sqrt{2}}\right) = \frac{(4-2\sqrt{2})(2+\sqrt{2})}{2^2-2} = \frac{8+4\sqrt{2}-4\sqrt{2}-2(2)}{4-2} = \frac{4}{2} = 2 - 0\sqrt{2}$

(20) $a = 2$ **(21)** $b = 0$ **(22)** $c = 2$

If we solve the inequality $\left|\dfrac{2-x}{3}\right| \leq 2$, the solution is an interval of the form $[a, b]$.
The values of a and b are:

Solution: $\left|\dfrac{2-x}{3}\right| \leq 2 \Leftrightarrow \dfrac{|2-x|}{|3|} \leq 2 \Leftrightarrow \dfrac{|2-x|}{3} \leq 2 \Leftrightarrow 3\dfrac{|2-x|}{3} \leq 3(2) \Leftrightarrow |2-x| \leq 6$ so the inequality is satisfied by all numbers within 6 units of 2, so the solution is

$(-4, 8)$

(23) $a = -4$ **(24)** $b = 8$

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(25) The slope of the line perpendicular to the line $y = -\frac{x}{9}$ which passes through the point $(0, 0)$ is:

Solution: $-\dfrac{1}{-\frac{1}{9}} = 9$
