Task 1: Give it a go

Click on a question number to see how your answers were marked and, where available, full solutions.

Question Number	Score	
Question 1	4 / 4	Review
Question 2	3 / 3	Review
Question 3	6 / 6	Review
Question 4	5 / 5	Review
Question 5	2 / 2	Review
Total	**20 / 20 (100%)**	

Performance Summary

Exam Name:	SIT190 - Week 5 - Quiz - Short
Session ID:	15941749110
Student's Name:	COWLISHAW, Ethan Del (edcowlishaw)
Exam Start:	Wed Apr 03 2024 12:42:00
Exam Stop:	Wed Apr 03 2024 20:38:56
Time Spent:	1:40:55

SIT190 - Week 5 - Quiz - Short

Click on a question number to see how your answers were marked and, where available, full solutions.

Question Number	Score	
Question 1	4 / 4	Review
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Performance Summary

Exam Name:	SIT190 - Week 5 - Quiz - Short
Session ID:	11898830234
Student's Name:	COWLISHAW, Ethan Del (edcowlishaw)
Exam Start:	Wed Apr 03 2024 20:40:07
Exam Stop:	Wed Apr 03 2024 21:18:33
Time Spent:	0:38:25

1 & 3)

2) Review

a) Identify a question to ask

I need to understand how to do square root simplifications as I do not understand them. I also need to better understand the ranges of logs.

b) Identify & implement a strategy addressing this question

I plan to review the course materials and play around with my CAS calculator to find a way that works for me. If these do not help, I will request assistance from the teacher.

c) Describe the identified question and your implementation strategy

The question I got stuck on was simplifying $\sqrt{98}$. After I saw the answer to the question, I understood it better. I did not understand what it was even asking but after viewing it, I did, though I still did not understand how to do it. Course materials and calculator play are necessary.

4) Short reflection on improvements

I improved significantly, much like the other times I've done these quizzes. By reviewing course materials then finding factors on my calculator, I could understand what was happening to reach the correct answers. Without having some fun and trial & error on the calculator, I do not believe I would have understood what was happening.

Task 2: Index rules

1) Simply each expression, showing 1 rule/step

a) $12^2 4^3 - 4^2 4$

$12^2 4^3 - 4^2 4$
-> $(144 * 64) - (4^{2+1})$

Here we applied the multiplication rule $a^m \times a^n = a^{m+n}$.
We simply calculated $12^2 4^3$ as a is not the same, $12 \neq 4$
-> $9216 - 4^3$
-> $9216 - 64$
9152

b) $\frac{x^6 x^3}{x^2} + (4x^3)^2$

$\frac{x^6 x^3}{x^2} + (4x^3)^2$
We'll focus on $\frac{x^6 x^3}{x^2}$, where we apply the multiplication rule
-> $x^6 x^3 = x^{6+3} = x^9$
-> $\frac{x^9}{x^2}$
Then, we apply the division rule $\frac{a^m}{a^n} = a^{m-n}$
-> $\frac{x^9}{x^2} = x^{9-2} = x^7$

The equation now is $x^7 + (4x^3)^2$
Focusing on $(4x^3)^2$ now, we apply the bracketed multiplication rule $(ab)^n = a^n b^n$ to the 4
-> $(4)^2 = 4^2 = 16$
Then, we apply another variation of the bracketed multiplication rule, $(a^m)^n = a^{mn}$ to the x^3
-> $(x^3)^2$
-> x^{3*2}
x^6

The equation is now $x^7 + 16x^6$.
It can be further simplified by factoring now.
Each x has at least 6 powers, and there is only one number, 16.
We can therefore simplify by using the multiplication rules like so:
-> $x^7 + 16 * x^6$
-> $x^{7-6} = x^1$ (subtraction rule)
This is the smallest value that the internal brackets can be
$?(x \pm ?)$
For $16x^6$ to be achieved, we need to times 16 by x^6
-> $x^6(x \pm ?)$. This shows the multiplication rule. $x^6 + x^1 = x^7$
Then, we need to add the 16 in
-> $x^6(x + 16)$

c) $\frac{2x^{10} - 3x^2}{x^2}$

There is an opportunity to divide the common factor of x^2 exponents using the division rule.
-> $\frac{2x^{10} - 3x^2}{x^2}$
-> $\frac{2x^{10-2} - 3x^{2-2}}{x^{2-2}}$
-> $\frac{2x^8 - 3x^0}{x^0}$
-> $\frac{2x^8 - 3(1)}{1}$
In one fell swoop, we have removed the division entirely, one x^2 term, and significantly reduced the size of the fraction into
$2x^8 - 3$

2) Solve $13x^2 = 39$ for x

$13x^2 = 39$
-> $x^2 = \frac{39}{13}$
-> $x^2 = 3$
$x = \pm\sqrt{3}$

Task 3: Log rules

1) Simplify each log expression and state each rule as applied

a) $log_8(4) + log_8(2)$

$log_8(4) + log_8(2)$
We use the log law of addition to calculate this.

-> $log_8(4 \times 2)$
-> $log_8(8)$
The base and the number are identical, which is subject to the $log_a(a) = 1$ law.
$log_8(8) = 1$

b) $2log_2(12) - log_2(4)$

$2log_2(12) - log_2(4)$
We want to first recondense the $2log_2(12)$ statement into a subtractable statement using the log law
$log_a(m^n) = (n)log_a(m)$

$2log_2(12)$
-> $log_2(12^2)$
-> $log_2(144)$

Now we can subtract using the subtraction law $log_a(m) - log_a(n) = log_a(\frac{m}{n})$
$log_2(144) - log_2(4)$
-> $log_2(\frac{144}{4})$
and get the final answer of $log_2(36)$

2) Simplify $log_{15}(60)$ by changing base

Changing base formula: $log_a(b) = \frac{log_c(b)}{log_c(a)}$

$log_{15}(60) = 1.512$
-> $a = 15$ and $b = 60$
-> $\frac{log_{60}(60)}{log_{60(15)}}$
$= \frac{1}{log_{60}(15)}$
$= 1.512$

Given these factors, the best options seems to be to get rid of one of the logs. As far as I am aware, there is no way to get a clean number that can be calculated without a calculator (at least not without major headache).

Factors of 60:

- $1 * 60$
- $2 * 30$
- $3 * 20$
- $4 * 15$
- $5 * 12$
- $6 * 10$

Factors of 15:

- $1 * 15$
- $3 * 5$

3) Solve for x

a) $ln(x + 3) = 7$

-> $e^{ln(x+3)} = e^7$
-> $x + 3 = e^7$
$x = e^7 - 3 = -2.901$

b) $e^{4x-7} = 8$

-> $ln(e^{4x-7}) = ln(8)$
-> $4x - 7 = ln(8)$
-> $4x = ln(8) + 7$
$x = \frac{ln(8)+7}{4} = 2.270$

Task 4: Cultural contribution

1 & 2) Describe an application in Ancient Egypt requiring mathematics and why was it needed?

The Ancient Egyptians used mathematics for the calculation of labourer wages which would have been necessary to find the correct and fair distributions for the employed individuals (Dubbey; 1975).

3) Solve $x + \frac{3x}{24} = 11$ using Egyptian heap-calculation

-> Guess of $x = 8$
-> $8 + \frac{3(8)}{24} = 11$
-> $8 + \frac{24}{24} = 11$
-> $8 + 1 = 11$

$9 \neq 11$
Since the left does not equal the right, we divide the RHS by the LHS
-> $\frac{\text{RHS}}{\text{LHS}} \rightarrow \frac{11}{9}$
Multiply our guess ($x = 8$) by this fraction to find the true value of x
-> $8 \times \frac{11}{9}$
-> $\frac{88}{9} = 9.7\dot{7}$

Verify
$x + \frac{3x}{24} = 11$
-> $\frac{88}{9} + \frac{3(\frac{88}{9})}{24} = 11$
-> $\frac{88}{9} + \frac{\frac{88}{3}}{24} = 11$
-> $\frac{88}{9} + \frac{11}{9} = 11$
-> $\frac{99}{9} = 11$
$11 = 11$

4) Solve $x + \frac{x}{3} = 16$ using modern methods

$x + \frac{x}{3} = 16$
We multiply the whole left side by 3, not just the $\frac{x}{3}$

-> $3\left(x + \frac{x}{3}\right) = 3(16)$
-> $3x + x = 48$
-> $4x = 48$
-> $x = \frac{48}{4}$
$x = 12$

Verification
$x + \frac{x}{3} = 16$
-> $12 + \frac{12}{3} = 16$
-> $3(12 + \frac{12}{3}) = 3(16)$
-> $36 + 12 = 48$
$48 = 48$

5) Do you prefer heap-calculation or modern algebraic methods?

I do prefer the modern methods as they have literally less guess work and they seem to result in cleaner, easier to calculate fractions too.
There is something strangely appealing about having to have a stab-in-the-dark when doing your maths that I enjoy about the Ancient Egyptian method. It strongly coincides with how I've felt about maths being a guessing game rather than intuitive like others feel (though this is feeling less true by the day).

References

Dubbey J M; (1975) 'Mathematics of Ancient Egypt', *Mathematics in School*, 4(5):26-28; https://www.jstor.org/stable/30211437