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Using E-learning Support as a Sustainable Communication Tool

Noor Ally, Deonarain Brijlall, Surversperi Suryakumari Rajah, David Day, Adhir Maharaj and Darren Lortan

Department of Mathematics, Durban University of Technology, South Africa

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ABSTRACT A great emphasis is placed on improving students' mathematics performance levels in the South African higher education institutions. In the main study, the researchers will develop and explore the impact e-learning support materials have on a group of engineering students at a South African University of Technology. The researchers designed a basic mathematics pre-test to identify areas of weaknesses and strengths. In this paper (which is part of a broader study), the researchers identify those areas of concern and provide a rationale for e-learning as a sustainable communication tool. The researchers adopted the domains of sustainable learning as a conceptual framework. It was found that the previous study findings, the availability of e-learning resources and the analysis of data all satisfy the demands of the three domains of sustainable learning. With these findings, the researchers deduced that e-learning can be adopted as a sustainable tool to communicate effective mathematics learning.

INTRODUCTION

National Benchmarking Tests (NBTs) that are written by the Durban University of Technology (DUT) students across all programs, which are serviced by the Mathematics Unit, have revealed a low level of preparedness in Basic Mathematics for higher education. Brijlall and Maharaj (2015) and Maharaj et al. (2015) have explored ways in which they thought they could address this low level of preparedness in Basic Mathematics. While the issue of remedying this serious problem lies firstly at the Basic Education level, Higher Education institutions cannot ignore the consequences of this situation, which present themselves with the accepted entry-level student cohort. Such students are at risk of failure in Mathematics in their first year of study and hence, require assistance early in their tertiary studies.

To improve conceptual understanding and competencies in these prior learning areas, interventions have to be made outside of the lectures. Previously, such interventions included additional tutorials during the week as well as on Saturdays. However, feedback from tutors and lecturers supervising such interventions indicated that students focused on the content discussed during lectures as well as revision of work in preparation for minor and major tests and not on improving basic mathematical skills. Given the time constraints during normal contact hours this is expected, since students are not directly tested on these prior learning areas and would hence, give importance to new work.

In this scenario, e-learning presents a suitable vehicle for implementing interventions outside of lectures and might be an effective communication tool for developing the students' conceptual understanding and procedural fluency in Basic Mathematics. It is proposed that "at risk" students be identified and inducted in a pathfinder project using e-learning as the primary mode of delivery for academic support in Basic Mathematics. In this study, the researchers used e-learning support materials to promote independent learning. This paper is different from the study by Tsuei (2014) who used a peer tutoring e-learning system to mediate mathematics learning for learners with learning disabilities.

The incorporation of e-learning would be examined over a long period in terms of,

- Design of learning, teaching and assessment material with Mathematical content.
- Communication through electronic devices between learners and tutors/lecturers in formats, which include Mathematical symbols and text.
- Multiple online assessments in an interactive e-environment with instant feedback and tutorial support.

Address for correspondence:
Deonarain Brijlall
Professor
37 Halpin Avenue
Reservoir Hills
4091, South Africa
Telephone: 031-3532126
E-mail: deonarainb@dut.ac.za

More importantly the researchers hypothesize that lecturer-student communication via e-learning will be a sustainable tool. It has been shown in South Africa that electronic exchange of health-related data collected or analyzed through electronic connectivity has proven to be an effective healthcare delivery strategy (Coleman 2014: 1). In this paper, the researchers unpacked the concept of resource-based views and knowledge-based views. It was revealed by Coleman (2014) that Information and Computer Technology (ICT) and e-health infrastructure has been procured for hospitals in South Africa. It was also found that ICT and e-health knowledge and skills acquired by doctors and nurses was tacit knowledge in nature and was transferred from friend to friend via verbal communication. Chetty (2014) in his paper emphasizes the need for integration of Information, Computer and Technology Systems (ICTS) in the education environment. Chetty (2014) thinks that such an environment is set to change the face of higher education. He also revealed that this changing environment is here to stay as it is taking favour by students. Kangethe (2014) also emphasized the role of modern media in information and message dissemination.

Research Framework

The researchers in this paper adapted the research framework formulated by Asiala et al. (1997). This framework has been effectively adapted in many other South African studies (Brijlall and Maharaj 2009; Brijlall et al. 2011; Brijlall and Ndlovu 2013). In Figure 1, the researchers show how the underlying structure of this study was conceptualized within this framework. For the theoretical analysis they employed the three domains of sustainable e-learning. These domains informed the study appropriately in terms of the desired research questions, which were explored. Also, the design and implementation of the pre-test was aptly carried out. The pre-test items addressed concepts in numeracy, exponents, surds, algebraic expressions, algebraic fractions, linear and quadratic equations, functions and trigonometry. The data arising from the students' written responses was collected and analyzed. This data analysis and discussion was redirected to the theoretical analysis so as to motivate the conclusions made by the researchers.

Conceptual Framework

This paper was guided by the *domains of sustainable e-learning*. Stepanyan et al. (2013) formulated a coherent body of knowledge on sustainable e-learning. In that paper they emphasize that the lasting success of e-learning endeavors is a growing concern for educational institutions that rely on governmental funding. In this study, the researchers considered the domains presented by Stepanyan et al. (2013). These domains are: 1) resource management, 2) professional development and innovation and, 3) educational attainment. These domains are not disjoint and possess overlaps.

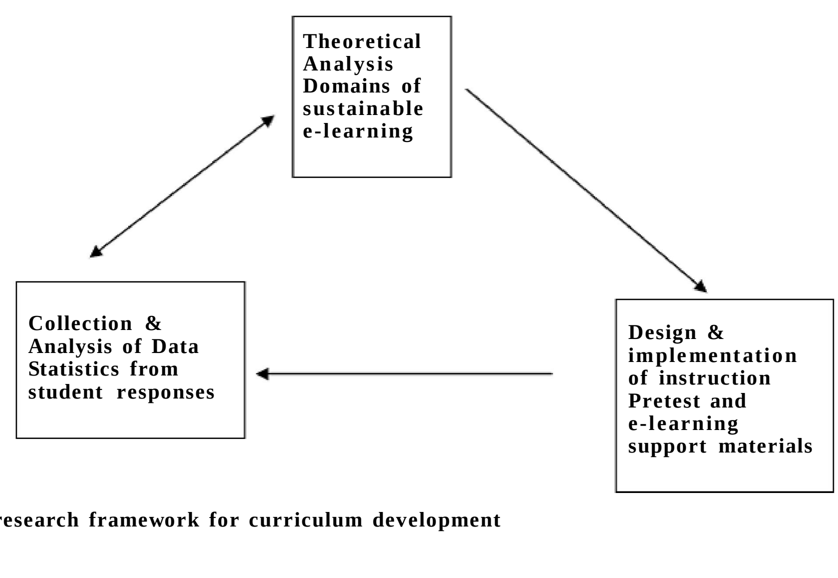

Fig. 1. A research framework for curriculum development

In terms of resource management, the researchers had to search for some effective equipment. The researchers will report in future research papers on the resource management. The researchers purchased tablets and chrome book combos. The tablets included a stylus. These devices were discreet, lightweight, capable of supporting simple word processing applications and a memory size suitable for e-learning support to be tested. Personnel needed:

- Monthly Scheduled Project Leader – a lecturer dedicated to controlling, supporting, and interacting with the e-learning student control group. Includes the overseeing of the online course and monitoring the students' general interest in the project. Analysis of results.
- A person (could be a postgraduate student or admin assistant with a technical background) who will be responsible for typing the content of the class, typing the tests and building the database for the multiple choice questions (MCQs) and practice tests.
- A person to maintain and manage the technical aspects of developing the Blackboard Class, create a student friendly environment.
- Supporting lecturers and team members – lecturers assisting with notes of lessons, design of multiple-choice questions, and quizzes and other assessments. Includes feedback, and discussing and chatting with students when necessary.

These devices had to be taken into account for both, the learning and teaching needs. Building an adaptive concept-based and web-based electronic system requires a lot of work and in this study it started from scratch. The researchers considered a typical environment for the development of an e-learning web space, where various systems collaborate to satisfy the users' (students') needs and the authors' (lectures') intentions.

Student Support Needs

To ensure that the students could work comfortably the researchers took into account the following.

- Students would need to access the LMS both, on and off campus.
- Devices would need word processing capability, which handles equation-editing software.
- The input devices for answering MCQ quizzes should be capable of supporting software such as, Scientific Workplace that are used in the design of assessments.
- Where necessary, license issues and costs for the software would have to be examined.
- Since it would be time consuming for students to type lengthy written answers to the questions, the researchers had to research devices that were capable of handling handwritten input in Mathematical format and access to scanning devices.

Teaching Support (Authors') Needs

To ensure that the lecturers could work with as little challenges as possible, the following was ensured.

- Software capable of generating MCQ tests from a database. These tests would be designed with programmed randomized input. The software would need to have built-in mathematical functions commonly used in Mathematics (for example, differentiation and integration) and generate solutions of the tests.
- Input devices capable of converting technical Mathematics content in handwritten notes into typed format. This study placed emphasis on the domain educational attainment.

The researchers will report on the student support in forthcoming papers. It is assumed that the author/s domain (Stepanyan et al. 2013) is well qualified as the student environment and authoring environment is heavily reliable on it. The researchers for this study comprised the lecture/s. It is expected that these lecturers have a thorough background in both mathematical knowledge. Brijlall and Maharaj (2014) and Bansilal et al. (2014) have shown that if the instructor is not solidly rooted in his/her expertise then there will be a collapse in student learning (2014). Also it has been shown that there are strong links between content knowledge of university lecturers and classroom practice (Brijlall 2011; Brijlall et al. 2012; Brijlall and Isaac 2011).

METHODOLOGY

In this section the researchers present the research questions, the research paradigm and research methods used for the data collection.

"Methodology refers to the coherent group of methods that complement one another and that have the 'goodness of fit' to deliver data and findings that will reflect the research question and suit the research purpose" (Henning 2004: 36). According to Cohen et al. (2007: 47), research methods are a "range of approaches used in educational research to gather data, which are to be used as a basis for inference and interpretation, for explanation and prediction". The researchers adopted a mixed mode approach for the analysis of data.

The aims of the study were to determine:

- The effectiveness of e-learning practices used in this study on remediating basic mathematical gaps in prior learning, which have been identified in the 'at risk' students.
- The statistical impact on remediating Basic Mathematical gaps on the Mathematics 101 pass rate.

These aims were sort to foster a rationale for the use of e-learning as a sustainable communication tool in the mathematics learning process. With these aims in mind, the researchers formulated the critical research question: *How can the use of e-learning support materials sustain the academic performance of at risk first-year engineering students?*

A purposefully selected sample of first-year engineering students was chosen for this project. For this paper, the researchers focus on the pre-test. It is hoped that the pre-test would indicate the areas of weaknesses in the students. Once these mathematical weaknesses are identified, other e-learning support materials would be designed to foster e-learning over a sustained time frame. A special pre-test on basic mathematical competencies, which were prior learning requirements for Math 101, was carried out on all entry-level Math 101 students. Students who achieved a mark of less than fifty percent were identified as 'at risk'. Students repeating Math 101 were also included in the 'at risk' group. The experimental sample, for future research, comprised 30 students from the 'at risk' cohort. The researchers ensured that these students are from a variety of school backgrounds, including township schools, private schools, ex-model C schools and rural schools.

DATA ANALYSIS AND DISCUSSION

Thirty-five questions from the following sections formed the test: numeracy, exponents, surds, algebraic expressions, algebraic fractions, linear and quadratic equations, functions and trigonometry. The duration of the test was 1.5 hours. Students were not allowed to use calculators. The total number of students who wrote the pre-test on 25th July 2014 comprised 95 mechanical engineering students and 52 industrial engineering students. These students were all registered for a first course in mathematics. Questions were also graded on cognitive levels. These are shown in Table 1.

Table 1 shows the questions coded per section and categorized according to four levels described in DoBE (2011:53). These levels include L1 (knowledge), L2 (routine procedures), L3 (complex procedures) and L4 (problem solv-

Table 1: Sections and cognitive levels

Question number	*Section*	*Sub-section*	*Cognitive level (L)*
1	Numeracy		1
2	Numeracy		1
3	Exponents and Surds		2
4	Ratio and percentages		3
5	Exponents and Surds		3
6	Algebra	Expressions	1
7	Algebra	Expressions	1
8	Algebra	Expressions	2
9	Algebra	Expressions	2
10	Algebra	Expressions	2
11	Algebra	Expressions	2
12	Algebra	Fractions	2
13	Algebra	Fractions	3
14	Algebra	Fractions	2
15	Algebra	Fractions	1
16	Algebra	Equations	2
17	Algebra	Equations	2
18	Algebra	Equations	3
19	Algebra	Equations	2
20	Algebra	Inequalities	2
21	Functions	Function values	2
22	Functions	Function values	2
23	Functions	Line	2
24	Functions	Line	1
25	Functions	Parabola	1
26	Functions	Parabola	1
27	Functions	Parabola	1
28	Functions	Hyperbola	1
29	Trigonometry	Special Angles	2
30	Trigonometry	Identities	2
31	Trigonometry	Identities	2
32	Trigonometry	Special angles/Inverses	3
33	Trigonometry	Definition of trig ratios	1
34	Trigonometry	Definition of trig ratios	2
35	Trigonometry	Definition of trig ratios	2

ing). The researchers coded the levels individually, and later a collective discussion ensued to reach consensus on these levels. Only the differed levels were interrogated until agreement was achieved.

Although the engineering students who participated in this study are university students, the researchers used the cognitive levels used for high school learners. This was done since the majority of students just completed their schooling and were now attempting a first mathematics course at university. Eleven of the questions were at level 1, eighteen questions at level 2 and six at level 3. Table 2 shows the overall report on the pre-test.

Table 2: Overall report on pre-test

Negative marking used	*N*
Number of test papers processed:	147
No of questions in the test:	35
Total number of marks:	35
Number of candidates scoring 40% or higher:	139
Number of candidates scoring 50% or higher:	106
Mean percentage:	60
Mean:	21.14

Of the 147 engineering students who wrote the test, 106 students scored more than fifty percent (see Table 2). The forty-one students who scored less than fifty percent were categorized as “as risk” (AR) students. This meant that these students required greater attention and support in mathematics. It is from these AR students that the researchers chose the group of students who would participate in using the e-learning support materials the researchers designed to communicate effective mathematics learning. Table 2 reveals that the mean mark scored was about 21. This was unacceptable by the standards expected by the researchers since they felt that a large percentage (about 82%) of questions were placed on levels 1 and 2. Questions on these levels expected students to rely on recall or routine mathematical procedures. For example, question 24 (see appendix) dealt with the writing of the equation $3x - 5y = 10$ in standard form. This is actually first introduced in grade nine in South African schools. So these students would have come across this notion several times before coming to university. Of course this basic notion will be a prerequisite for further learning at university, and hence will have to be given serious attention by the researchers when designing the e-learning materials to communicate tasks, which would hopefully remediate this error or misconception. The researchers now highlight in Table 3 the performance of students, question-wise.

Question 32, at level 3, was most poorly answered with about sixteen percent of students getting it correct (see Table 3). This question expected the students to evaluate sin $(2x+30^0)$ after determining the solution for the unknown in the first quadrant if $\cos x=1/2$ (see appendix). Since calculators were not allowed, it is possible that many students could not recall the special angles ratios. The majority of the students chose C as the answer (see Table 4). It could be that the students obtained angles that were bigger than sixty degrees and once substituted to determine the value of sin $(2x-30^0)$, the angle was an obtuse angle implying that the terminal side lay in the third quadrant. Even if students did get the correct answer of sixty degrees on substitution were expected to determine sine of ninety degrees without a calculator and that could have presented a challenge as they are heavily dependent on calculators in schools. Maharaj et al. (2015) in their study found a similar reliance by students on calculators. For this reason, Brijlall and Maharaj (2015) provided their students with mathematical tasks which did not rely on calculator usage and observed how the students attempted the solutions of such tasks.

In Table 3 the readers observe that about one-fifth of the students got question 28 correct. This question dealt with finding the equation of a hyperbolic function whose graph was provided (see appendix). Thirty percent of the students chose option C (see Table 4). This choice was absurd since this meant that this group of students could not differentiate between the graphs of exponential functions and hyperbolic functions. The researchers placed question 28 on cognitive level one (see Table 1). This was done with the rationale that the shape of the graph should provide a straightforward recall of a representation of a hyperbolic function. The researchers thought that one factor that might have contributed to this was that the hyperbolic function is generally written by the

Table 3: Student performance question-wise n = 147

Question number	*Number correct*	*% correct*	*Question number*	*Number correct*	*% correct*
1	125	85.03	19	135	91.84
2	81	55.10	20	112	76.19
3	94	63.95	21	69	46.94
4	84	57.14	22	88	59.86
5	52	35.37	23	109	74.15
6	102	69.39	24	107	72.79
7	129	87.76	25	50	34.01
8	69	46.94	26	86	58.50
9	45	30.61	27	131	89.12
10	121	82.31	28	29	19.73
11	126	85.71	29	71	48.30
12	108	73.47	30	102	69.39
13	53	36.05	31	59	40.14
14	106	72.11	32	24	16.33
15	65	44.22	33	97	65.99
16	101	68.71	34	97	65.99
17	112	76.19	35	120	81.63
18	49	33.33			

rule, $y=k/s$ for $x \neq 0$ in school textbooks. It might be that this group of students who chose C as the answer could not relate the product form of the equation expressed in the question. In fact, fifty-seven percent of the students chose the exponential function. This meant that more of the students could not identify graphs representing hyperbolic functions. This implies that there is certainly the need for designing e-learning support materials to address these student mathematical shortfalls. Further these e-learning support materials would need to be designed so as to communicate effective mathematics learning over a long period of time. Also, these e-learning support materials will contribute to addressing the domain of educational attainment demonstrated by the theoretical framework presented by Stepanyan et al. (2013). Question 19 was answered reasonably well (see Table 3). About ninety-two percent of the students opted for A (see Table 4). This question (see appendix) required the students to write one variable in terms of expressions involving numeral and literal constants. The researchers placed question 32 on cognitive level three (see Table 1). This was done prior to the analysis of data.

It seemed that the placement concurred with the level of difficulty experienced by these engineering students. Although the use of inverse cosine functions was regarded as routine, the researchers thought that synthesizing this concept with the search of the correct quadrant and relating it to the sine function made it non-routine. The question also highlights the reliance on the use of calculators. Since calculators were not allowed, it is quite likely that many students could not recall the function values of special angles.

CONCLUSION

The thirty-five multiple choice questions covered basic skills and competences required in numeracy, exponents, surds, algebraic expressions, algebraic fractions, linear and quadratic equations, functions and trigonometry. These focused tasks were used as a means to test the level of mathematical understanding of engineering students at a university of technology. A pre-test was used to explore the need for a sustainable tool to communicate effective mathematics learning. Within the theoretical framework the researchers found that the demands of the domains of sustainable learning could be met. The domain of resource management was necessary and this pre-test was a starting point in this domain. In the domain of professional development the researchers think that they have the relevant expertise to meet the demands of this domain. This is further justified by other studies mentioned earlier in this paper at the university to which the researchers are attached. The data analysis and discussion has clearly shown that further steps to address student

Table 4: Student answers per option

Item number	A	A %	B	B %	C	C %	D	D%	E	E %	
1	3	2	1	1	125	85	17	12	1	1	Ans:C
2	10	7	8	5	43	29	81	55	3	2	Ans:D
3	94	64	12	8	15	10	25	17	0	0	Ans:A
4	4	3	39	27	84	57	16	11	0	0	Ans:C
5	42	29	52	35	15	10	34	23	1	1	Ans:B
6	10	7	102	69	20	14	10	7	1	1	Ans:B
7	1	1	15	10	0	0	129	88	0	0	Ans:D
8	69	47	24	16	32	22	15	10	3	2	Ans:A
9	4	3	83	56	12	8	45	31	1	1	Ans:D
10	3	2	121	82	10	7	8	5	0	0	Ans:B
11	126	86	5	3	4	3	9	6	1	1	Ans:A
12	4	3	108	73	23	16	12	8	0	0	Ans:B
13	22	15	54	37	53	36	14	10	1	1	Ans:C
14	23	16	4	3	12	8	106	72	1	1	Ans:D
15	65	44	35	24	5	3	41	28	0	0	Ans:A
16	13	9	101	69	24	16	5	3	0	0	Ans:B
17	20	14	2	1	10	7	112	76	1	1	Ans:D
18	26	18	49	33	42	29	21	14	0	0	Ans:B
19	135	92	5	3	4	3	0	0	0	0	Ans:A
20	14	10	12	8	112	76	6	4	1	1	Ans:C
21	4	3	18	12	53	36	69	47	1	1	Ans:D
22	20	14	23	16	88	60	16	11	0	0	Ans:C
23	11	7	109	74	5	3	21	14	0	0	Ans:B
24	107	73	16	11	18	12	6	4	0	0	Ans:A
25	67	46	50	34	25	17	4	3	0	0	Ans:B
26	28	19	19	13	13	9	86	59	0	0	Ans:D
27	10	7	131	89	5	3	0	0	1	1	Ans:B
28	31	21	29	20	44	30	39	27	0	0	Ans:B
29	22	15	7	5	71	48	41	28	1	1	Ans:C
30	102	69	23	16	10	7	10	7	0	0	Ans:A
31	59	40	31	21	30	20	19	13	1	1	Ans:A
32	14	10	26	18	72	49	24	16	1	1	Ans:D
33	27	18	97	66	12	8	6	4	0	0	Ans:B
34	17	12	8	5	97	66	19	13	0	0	Ans:C
35	7	5	11	7	120	82	6	4	0	0	Ans:C

mathematical shortfalls are of dire necessity. This will address the domain of educational attainment. The researchers are of the opinion that these e-learning initiatives would be sustainable tools to communicate effective mathematics learning. This is supported by the theoretical framework adopted, which has been formulated on the grounds of sustainability.

RECOMMENDATIONS

This paper has shown the need for the design of more e-learning support materials to promote sustainable tools to communicate effective mathematics learning. It is recommended that other e-learning support materials like: a) Web-Links including study guides, e-texts, video clips, b) Announcements including test details and seating arrangements, any other news items, c) Discussion, Chats and d) Module content including notes of lessons, tutorial questions with solutions, MCQ's, practice tests, past examination and test papers, additional notes, articles of interest, remedial exercises on poor performance learning areas identified through tests need to be designed. The researchers involved in this study also recommend that: a) communication through electronic devices between learners and tutors/lecturers in formats, which include Mathematical symbols must be encouraged and b) multiple online assessments in an interactive E-environment with instant feedback and tutorial support are vital for sustainable support.

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APPENDIX

E-learning: Mathematics Pathfinder Project
Weekly questionnaire
Name of participant: ……… Student number: ...…….

Pre-test

1. Which value is the largest?
A. 8.35 B. 0.835 C. 83.5 D. $8\frac{35}{100}$

2. Which number is the odd one out?
A. 0.45 B. $\frac{45}{100}$ C. $\frac{9}{20}$ D. 4,5

3. Find the value of $\sqrt{25}+\sqrt[3]{27}+\sqrt[4]{16}$
.
A. 10 B. 18 C. 16 D. 12

4. A rugby player scores 65% of his team's 40 points. How many points were scored by the rest of his teammates?
A. 65 B. 26 C. 14 D. 35

5. Evaluate: $\left(\frac{1}{2^{-1}+3^{-1}}\right)^2$
A. 25 B. $\frac{36}{25}$ C. $\frac{36}{25}$ D. $\frac{1}{25}$

6. Simplify: $3a^3(2ab^2)^3$
A. $18a^9b^6$ B. $24a^6b^6$ C. $24a^9b^6$ D. $18a^6b^5$

7. $2(x+1)^2$ can also be written as…
A. $(2x+1)^2$ B. $(2x+2)^2$ C. $4(x^2+2x+1)$
D. $2(x^2+2x+1)$

8. The highest power of x in the expression $[2(x^3+5)(x^2-1)]^4$ is
A. 20 B. 24 C. 9 D.96

9. Simplify: $\sqrt{x^2-2x+1}$ (one possible expression could be?)
A. x-1 B. $x-\sqrt{2x}+1$ C. x+2 D. None of these

10. Expand and simplify. $\left(x+\frac{1}{x}\right)\left(x-\frac{1}{x}\right)$
A. $x^2+\frac{1}{x^2}$ B. $x^2-\frac{1}{x^2}$ C. $x^2+2x+\frac{1}{x^2}$ D. x^2

11. Which of the following is a factor of both x^2-x-6 and x^2-5x+6
A. x-3 B. x+3 C. x-2 D. x+2

12. $\frac{a}{b}+\frac{b}{a}$ =
A. 2 B. $\frac{a^2+b^2}{ab}$ C. $\frac{a+b}{ab}$ D. a^2+b^2

13. Simplify: $\frac{a^2-b^2}{\frac{1}{a}-\frac{1}{b}}$
A. *a-b* B. a^3-b^3 C. *-ab(a+b)* D. *a+b*

14. Simplify: $\frac{x^3-2x^2+x}{x^2-2x+1}$
A. x B. x^3 C. $\frac{1}{x}$ D. x^3+1

15. Which answer is applicable to the following expression: $\frac{a}{b+c}$
A. Cannot be simplified B. $a \div b + c$
C. $\frac{b}{a}+\frac{c}{a}$ D. $\frac{a}{b}+\frac{a}{c}$

16. Solve for t: $3t-5=\frac{2}{7}$
A. $\frac{37}{21}$ B. $\frac{10}{21}$ C. $\frac{1}{3}$ D. $-\frac{1}{7}$

17. Find one root of the equation: .
A. x =-1 B. x=0 C. x=7 D. x=1

18. If α and β are the roots of the equation $2x^2$+5x-18=0, what is the value of α + β ?
A. $-\frac{5}{2}$ B. 10 C. 50 D. 0

19. Find *x* in terms of a and b if $\frac{3x}{7b}=-2a$
A. $-\frac{5}{2}$ab B. 10ab C. $-\frac{14}{3}ba$ D. 0

20. Solve for x: -3x+8$\geq$ - 4. .
A. $x<4$ B. x$\geq$-4 C. x $\leq$ 4 D. $x \leq -\frac{4}{3}$

21. If $f(x)=\sqrt{x^2+25}$ find the value of
A. $5\sqrt{2}$ B. 10 C. 50 D. 0

22. If *f(x)= x2 - 2 x + 4.* then *f(a-1)* =
A. a^2 -2a+5 B. a^2-4a+3 C. a^2-4a+7 D. a^2-2a+4

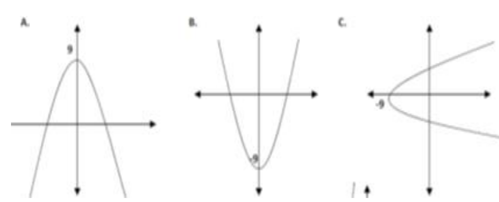
23. The standard form of the line given by the equation *3x - 5y = 10* is
A. $y=\frac{3}{5}x+10$ B. $y=\frac{3}{5}x-2$ C. $y=\frac{5}{3}x+2$ D. $y=-\frac{3}{5}x+2$

24. If the line with equation *y=-3x-1* is parallel to the line with equation *y = ax +5* then the value of a is
A. -3 B. 3 C. 1/3 D. -1/3

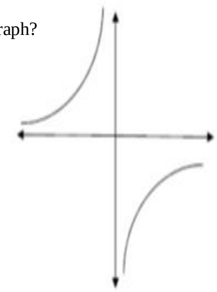
25. The parabola with equation y = $-x^2$ -4 has
A. Two x-intercepts B. No x-intercepts
D. One x-intercept D. No y-intercept

26. The parabola having y=(x=-$(x+3)^2$-5 equation has a maximum turning point at
A. (3;-5) B. (-3;5) C. (-3;-5) D. (-5;-3)

27. Which of the following is a representation of the function y= x^2-9 ?



28. Consider the following graph,
Which equation best describes the graph?



A. xy = k, k>0
B. ry = k,k<0
C. y-k3,k>0
D. y=k3, k <0

29 If $\theta = 60^o$ $find\ the\ value\ \ sin\frac{\theta}{2} + \frac{cos\theta}{2}$.

A. $\frac{1}{4}$ B. $-\frac{1}{4}$ C. $.\frac{3}{4}$ D. $.\frac{1}{2}$

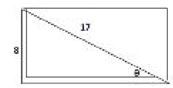
30 Find the value of 1-sin^2 θ-cos2 θ .
A. -1 B. 1 C. D.2

31 Simplify the following: $\frac{\sqrt{1 - sin^2x}}{cosx}$

A. -1 B. 10 C.0 .2

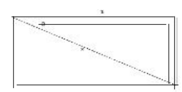
32 Calculate the value of (2x-30) correct to two decimal places if $cos\ x = 0,5$ and $x\varepsilon\ [0^0;\ 90^0]$.
A. 117.38^0 B. $242,61^0$ C.-0,45 D.0,45

33 Using the information in the right angled triangle, what is the value of cos0.



A. $\frac{8}{17}$ B. $\frac{15}{17}$ C. $\frac{17}{8}$ D. $\frac{15}{8}$

34 In the right-angled triangle shown, what is θ ?



A. x B. $x\sqrt{x^2 - 1}$ C. $\sqrt{x^2 - 1}$ D. $x - 1$

35 Use the information in the figure (in question 34) to find sinθ, tanθ.

A. $\frac{a^2}{cb}$ B. $\frac{b}{c}$ C. $\frac{b^2}{ca}$ D. $\frac{ac}{b^2}$