Paper 1 - CALCULATOR INACTIVE

Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written work. You are advised to show all working.

SECTION A

Answer all questions in the spaces provided.

1. Simplify the expression $\dfrac{\left(2xy^{-2}\right)^{3}\left(x^{-1}y\right)^{-2}}{32xy^{-3}}$. Your final answer should not have any negative exponents. *[4]*

2. Evaluate the following expressions. Express all final answers as reduced fractions where possible.

(total 6 marks)

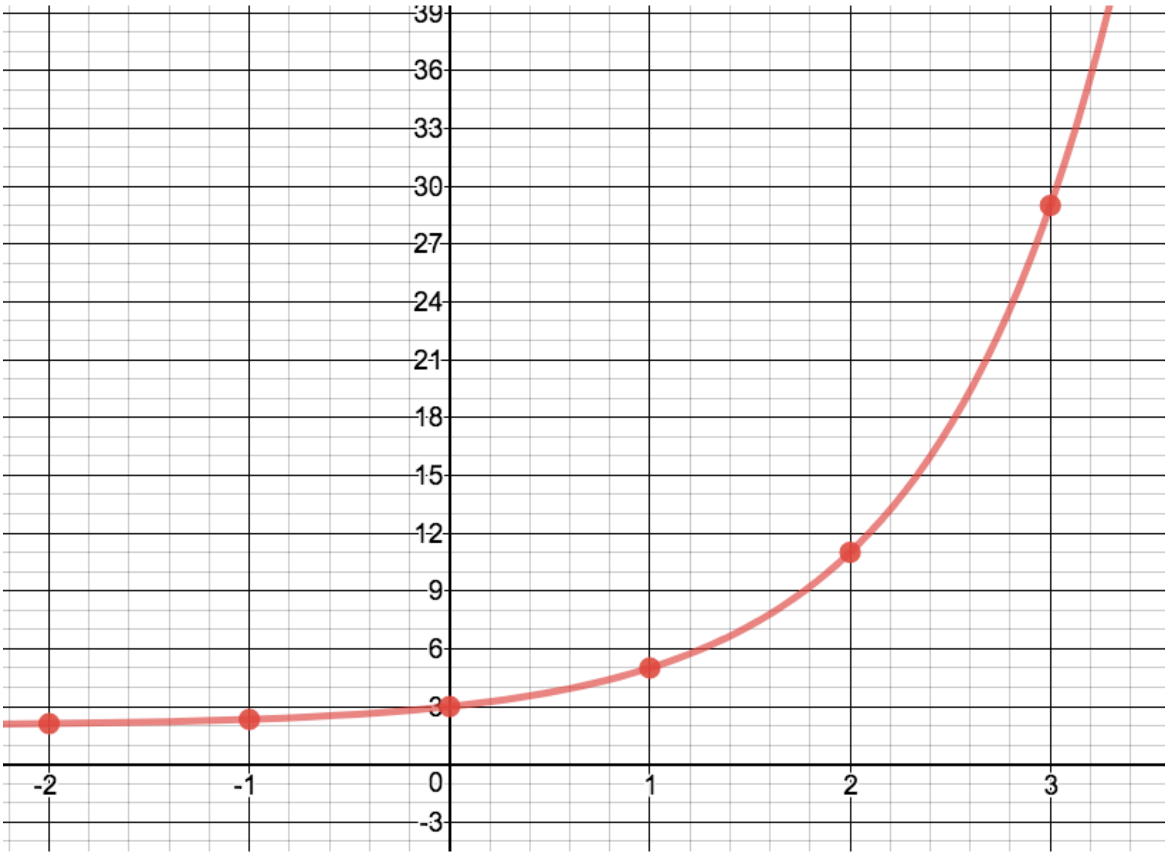
a. $32^{-\frac{3}{5}}$. *[2]*

b. $16^{-1}+\left(\left(\frac{1}{3}\right)^{-2}+4^{-\frac{1}{2}}\right)^{0}$. *[2]*

c. $\log_4 8$. *[2]*

3. Here is the graph of a function. Determine the equation of the function, showing/explaining the key steps of your analysis.

(total 4 marks)



4. Solve the following exponential equations. Show the key steps in your solutions.

(total 6 marks)

a. $3^{1-x} = \frac{1}{9}$. *[3]*

b. $5^{x+1} = \left(\frac{1}{5}\right)^{2x+5}$ *[3]*

SECTION B

Do NOT write solutions on this page. Answer all questions on the answer sheets provided.

5. Mrs Knox is carefully monitoring a chemical spill that happened on Saturday in her science lab. She accidentally spilled radioactive milk and she knows that she can model the amount of radioactivity left in the lab using the model $A(t) = 32\left(\frac{1}{2}\right)^{\frac{t}{4}}$, where the amount of radioactivity, A, is measured in becquerels and t is time measured in hours since the accident happened.

(total 6 marks)

   a. Explain how we know that the model she is using is a decay equation. *[1]*

   b. What is the half-life of the radioactive milk? (Half-life being defined as the time it takes for the amount of the substance to be halved.) Show/explain how you determined your answer. *[1]*

   c. If the spill occurred at noon (12:00pm), what amount of radioactivity is left at midnight (12:00am)? *[2]*

   d. Her classroom will be "safe" only when there is less than 0.5 becquerels of radioactivity in her classroom. What time of the day will her class first be "safe"? *[2]*

6. Mr. S. is trying to graph the following function $f(x) = -(2)^x + 4$, but needs your assistance (hahahahahaha!!!!!!)

(total 15 marks)

   a. Where does the graph of the function have its asymptote? *[1]*

   b. Determine the value of the y-intercept. *[2]*

   c. Evaluate $f(3)$ as well as $f(-2)$. *[3]*

   d. Determine the x-intercept of the function. *[2]*

   e. Sketch the function on the grid provided, labelling the information you determined in the previous questions. *[3]*

   f. State the domain and range of this function. *[2]*

   g. Mr. Rawlings wonder what this graph would look like, if it were reflected across the line $y = x$. Sketch it and explain to Mr. R. how you determined what the graph should look like. *[2]*

Paper 2 – CALCULATOR ACTIVE

Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. In particular, solutions found from a graphic display calculator should be supported by suitable working, e.g. if graphs are used to find a solution, you should sketch these as part of your answer. Where an answer is incorrect, some marks may be given for correct method, provided this is shown by written working. You are therefore advised to show all working.

SECTION A

Answer all questions in the spaces provided.

1. Mr. Smith would like his IM1 class to solve the equation $4^{2x-1} = 7$. Show/explain **two** different ways that he could teach his IM1 class about solving this exponential equation. Finally, what is the solution to the equation?

(total 4 marks)

2. Mr. Rawlings has compiled the following data set, wherein he keeps track of how many golf balls he looses every week he plays golf!!!

(total 6 marks)

Number of weeks played	0	1	2	3	4	5
Number of golf balls lost during that week	68	55	44	36	29	23

a. Show that the data is exponential. *[2]*

b. Determine the decay ***factor***. *[1]*

c. Determine the decay ***rate***. *[1]*

d. Determine the algebraic rule that describes these data. *[1]*

e. Will he ever go a week without loosing a golf ball? Explain your answer. *[1]*

3. The following questions deal with investments that Mr. D. has recently made, in order to start saving for his retirement.

(Total 8 marks)

   a. He invested \$20,000 into an investment that earns 7% p.a., compounded quarterly. He would like to know how much **interest** he has earned from this investment in 10½ years. Show/explain the analysis that leads to your final answer. *[4]*

   b. Today, he will invest some additional money so that he can purchase a house. The investment will earn 5% p.a. interest, compounded monthly. If he needs this new investment to be worth \$45,000 in 9 years, how much should he invest today? Show/explain the analysis that leads to your answer. *[4]*

SECTION B

Do NOT write solutions on this page. Answer all questions on the answer sheets provided.

4. In the year 2030, Sakshi has become a leading industrial entrepreneur, working for the Tata Group in India and due to her awesomeness, the company's profit starts to increase, according to the equation $P(t) = 150(1.0955)^t$, where P represents the annual profit, in billions of US dollars and t represents the years since 2030.

(total 9 marks)

   a. At what yearly rate does the Tata's Group profits increase? *[1]*
   b. What is the company's expected profit in 2050 (answer in billions of dollars)? *[2]*
   c. In what year will Tata Group's profits be $200 billion? Show/explain the analysis that leads to your answer. *[3]*
   d. Sakshi introduces changes to the way the company operates. As a result, the company's yearly rate changes. She notices that the profits have increased from $150 billion to $225 billion in 5 years. Determine the company's new annual rate of growth. *[3]*

5. Liam has become a world famous medical researcher who has developed a medicine to cure MATHITIS. Once the medicine is taken, it is used up as it kills the bacteria that cause MATHITIS. The mathematical model $A(t) = 50(0.85)^t$ can be used to describe the amount of medicine still left in the body, where t is the time in hours since the dose was taken and $A(t)$ is the amount of medicine left in the body measured in milligrams. Therefore a new dose of medicine is required every 8 hours.

(total 9 marks)

   a. Given the equation used to model this problem, what is the amount of the initial dose taken by a patient? *[1]*
   b. Explain what the point (3, 30.7) means in the context of this question. *[2]*
   c. How long does it take for HALF the medicine to get used up in the body? Show/explain your solution. (Round answer to the nearest tenth of an hour) *[3]*
   d. How much of the medicine is still in a patient's body after 8 hours (BEFORE they take their next dose?) *[1]*
   e. Ahmed takes a second dose exactly at 8 hours and a third dose, again after 8 hours. So 16 hours have passed. How much of the medicine remains in his body after a 24 hour time period? Show/explain the analysis that leads to your answer. *[2]*