

1. Answer each of the following questions, showing all working:

- (1) Populations of bacteria (and indeed many other organisms) exhibit population growth that can be modelled using continuous compounding. The rate of population growth depends on such factors as fertility, temperature, level of interactions and so on.
A certain type of bacterium has a population growth rate of 0.08 per hour. If there are 400 million bacteria in a petri dish at time 0, how many will there be after 7 hours? (Give your answer in millions, rounded to two decimal places.)
- (2) 0.05 of a certain radioactive substance decays every 1000 years. If the initial quantity of the substance is 100 units, how many units will remain after 20 thousand years? (Round your answer to two decimal places.)
- (3) Peter needs to pay a bill of \$900 in 5 years' time. His bank account earns 4.0 percent interest each year, compounding continuously. How much money does he need to invest now in order to exactly cover his bill in 5 years? Ignore fees and taxes, and round your answer to cents.
- (4) I invest \$400 in a bank account earning 5.0 percent interest per year for 12 years, continuously compounding. Ignoring taxes and fees, what is the final account balance?
- (5) Before Damien can marry Celeste, he must prove to her father that he can save the deposit for a house. He has \$900 to invest, his account pays 1.0 percent interest per annum, compounding continuously, and he needs to have a total of \$1710 before he can get married. He is currently 15 years old. At what age can he get married?
- (6) Peter the Mathematician is invited to attend the First International Congress of Mathematical Shoemaking to be held in Hawaii in 5 months' time. The problem is that Peter would be required to wear shoes but currently he doesn't have any. Clever Peter has a bank account earning 8.0% p.a., compounding monthly. How much money does he need to invest now in order to buy a pair of shoes and go to Hawaii, assuming the price of a pair of decent shoes is \$100 ? Ignore fees and taxes, and round your answer appropriately.

2. Answer each of the following questions, showing all working:

- (1) Populations of bacteria (and indeed many other organisms) exhibit population growth that can be modelled using continuous compounding. The rate of population growth depends on such factors as fertility, temperature, level of interactions and so on.
A certain type of bacterium has a population growth rate of 0.07 per hour. If there are 600 million bacteria in a petri dish at time 0, how many will there be after 9 hours? (Give your answer in millions, rounded to two decimal places.)
- (2) 0.04 of a certain radioactive substance decays every 1000 years. If the initial quantity of the substance is 600 units, how many units will remain after 13 thousand years? (Round your answer to two decimal places.)
- (3) Peter needs to pay a bill of \$500 in 7 years' time. His bank account earns 3.0 percent interest each year, compounding continuously. How much money does he need to invest now in order to exactly cover his bill in 7 years? Ignore fees and taxes, and round your answer to cents.
- (4) I invest \$100 in a bank account earning 2.0 percent interest per year for 17 years, continuously compounding. Ignoring taxes and fees, what is the final account balance?
- (5) Before Damien can marry Celeste, he must prove to her father that he can save the deposit for a house. He has \$800 to invest, his account pays 6.0 percent interest per annum, compounding continuously, and he needs to have a total of \$2160 before he can get married. He is currently 13 years old. At what age can he get married?
- (6) Peter the Mathematician is invited to attend the First International Congress of Mathematical Shoemaking to be held in Hawaii in 23 months' time. The problem is that Peter would be required to wear shoes but currently he doesn't have any. Clever Peter has a bank account earning 3.0% p.a., compounding monthly. How much money does he need to invest now in order to buy a pair of shoes and go to Hawaii, assuming the price of a pair of decent shoes is \$400 ? Ignore fees and taxes, and round your answer appropriately.

3. Answer each of the following questions, showing all working:

- (1) Populations of bacteria (and indeed many other organisms) exhibit population growth that can be modelled using continuous compounding. The rate of population growth depends on such factors as fertility, temperature, level of interactions and so on.

A certain type of bacterium has a population growth rate of 0.04 per hour. If there are 900 million bacteria in a petri dish at time 0, how many will there be after 11 hours? (Give your answer in millions, rounded to two decimal places.)

- (2) 0.09 of a certain radioactive substance decays every 1000 years. If the initial quantity of the substance is 800 units, how many units will remain after 9 thousand years? (Round your answer to two decimal places.)
- (3) Peter needs to pay a bill of \$1000 in 13 years' time. His bank account earns 6.0 percent interest each year, compounding continuously. How much money does he need to invest now in order to exactly cover his bill in 13 years? Ignore fees and taxes, and round your answer to cents.
- (4) I invest \$200 in a bank account earning 1.0 percent interest per year for 10 years, continuously compounding. Ignoring taxes and fees, what is the final account balance?
- (5) Before Damien can marry Celeste, he must prove to her father that he can save the deposit for a house. He has \$300 to invest, his account pays 5.0 percent interest per annum, compounding continuously, and he needs to have a total of \$720 before he can get married. He is currently 17 years old. At what age can he get married?
- (6) Peter the Mathematician is invited to attend the First International Congress of Mathematical Shoemaking to be held in Hawaii in 10 months' time. The problem is that Peter would be required to wear shoes but currently he doesn't have any. Clever Peter has a bank account earning 3.0% p.a., compounding monthly. How much money does he need to invest now in order to buy a pair of shoes and go to Hawaii, assuming the price of a pair of decent shoes is \$100 ? Ignore fees and taxes, and round your answer appropriately.

4. Answer each of the following questions, showing all working:

- (1) Populations of bacteria (and indeed many other organisms) exhibit population growth that can be modelled using continuous compounding. The rate of population growth depends on such factors as fertility, temperature, level of interactions and so on.

A certain type of bacterium has a population growth rate of 0.06 per hour. If there are 800 million bacteria in a petri dish at time 0, how many will there be after 14 hours? (Give your answer in millions, rounded to two decimal places.)

- (2) 0.04 of a certain radioactive substance decays every 1000 years. If the initial quantity of the substance is 1000 units, how many units will remain after 16 thousand years? (Round your answer to two decimal places.)
- (3) Peter needs to pay a bill of \$400 in 10 years' time. His bank account earns 7.0 percent interest each year, compounding continuously. How much money does he need to invest now in order to exactly cover his bill in 10 years? Ignore fees and taxes, and round your answer to cents.
- (4) I invest \$900 in a bank account earning 9.0 percent interest per year for 14 years, continuously compounding. Ignoring taxes and fees, what is the final account balance?
- (5) Before Damien can marry Celeste, he must prove to her father that he can save the deposit for a house. He has \$700 to invest, his account pays 10.0 percent interest per annum, compounding continuously, and he needs to have a total of \$1190 before he can get married. He is currently 19 years old. At what age can he get married?
- (6) Peter the Mathematician is invited to attend the First International Congress of Mathematical Shoemaking to be held in Hawaii in 21 months' time. The problem is that Peter would be required to wear shoes but currently he doesn't have any. Clever Peter has a bank account earning 9.0% p.a., compounding quarterly. How much money does he need to invest now in order to buy a pair of shoes and go to Hawaii, assuming the price of a pair of decent shoes is \$300 ? Ignore fees and taxes, and round your answer appropriately.

5. Answer each of the following questions, showing all working:

- (1) Populations of bacteria (and indeed many other organisms) exhibit population growth that can be modelled using continuous compounding. The rate of population growth depends on such factors as fertility, temperature, level of interactions and so on.
A certain type of bacterium has a population growth rate of 0.05 per hour. If there are 1000 million bacteria in a petri dish at time 0, how many will there be after 16 hours? (Give your answer in millions, rounded to two decimal places.)
- (2) 0.05 of a certain radioactive substance decays every 1000 years. If the initial quantity of the substance is 300 units, how many units will remain after 10 thousand years? (Round your answer to two decimal places.)
- (3) Peter needs to pay a bill of \$200 in 3 years' time. His bank account earns 1.0 percent interest each year, compounding continuously. How much money does he need to invest now in order to exactly cover his bill in 3 years? Ignore fees and taxes, and round your answer to cents.
- (4) I invest \$900 in a bank account earning 9.0 percent interest per year for 9 years, continuously compounding. Ignoring taxes and fees, what is the final account balance?
- (5) Before Damien can marry Celeste, he must prove to her father that he can save the deposit for a house. He has \$400 to invest, his account pays 2.0 percent interest per annum, compounding continuously, and he needs to have a total of \$920 before he can get married. He is currently 10 years old. At what age can he get married?
- (6) Peter the Mathematician is invited to attend the First International Congress of Mathematical Shoemaking to be held in Hawaii in 20 months' time. The problem is that Peter would be required to wear shoes but currently he doesn't have any. Clever Peter has a bank account earning 5.0% p.a., compounding monthly. How much money does he need to invest now in order to buy a pair of shoes and go to Hawaii, assuming the price of a pair of decent shoes is \$400 ? Ignore fees and taxes, and round your answer appropriately.