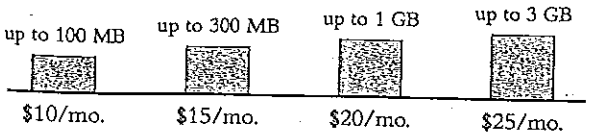
Topic Test: Mathematics and Communication

Total time allowed: 45 minutes **Total marks:** 35

1 Which of these plans charges a maximum 2 cents per megabyte of download?



A $10 per month
B $15 per month
C $20 per month
D $30 per month

2 A phone company charges 15¢ for each 30 seconds (or part thereof) for a phone call. It decides to increase the size of increments so it now charges 30¢ for each 60 seconds (or part thereof). This will cause customers to:

A Pay more for their phone calls
B Pay the same for their phone calls
C Pay less for their phone calls
D Pay varying amounts, depending on how often they use their phone

3 Which of these formulae is correct for mobile phone charges?

A Call charge
= Connection fee + Time used × Call rate
B Call charge
= Time used + Connection fee × Call rate
C Call charge
= Call rate + Time used × Connection fee
D Call charge
= Connection fee × Time used × Call rate

4 Which of these mobile phone uses will cost the least?

A Using the phone to receive calls and make the occasional emergency call.
B Talking to friends and relatives on an infrequent basis.
C Texting and regularly talking to friends and family.
D Texting and talking regularly as well as surfing the net.

5 A phone call is charged at 12¢ for each 15 seconds, or part thereof. What is the cost for a $3\frac{1}{2}$ minute call?

A 12¢
B 12×15¢
C 12×3.5¢
D $12 \times 3.5 \times 4$¢

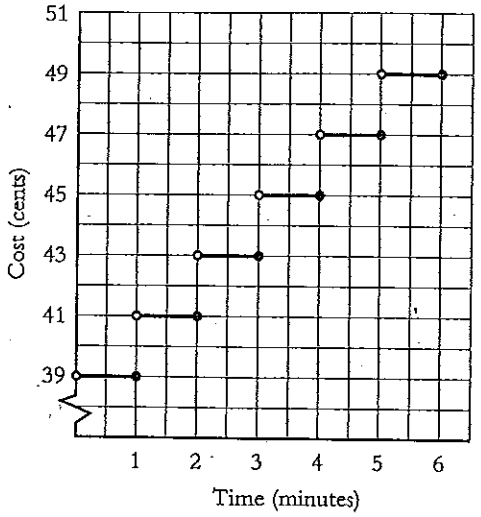
6 A prepaid mobile phone plan requires the user to:

A Pay by the minute rather than by the second
B Buy the credit after the call is made
C Purchase credit in advance
D Obtain a contract for the use of the phone

7 Tim pays 24¢ for each SMS he makes. In a month he makes 80 SMS messages. Tammy pays 20¢ for each of her SMS messages. How many messages can Tammy make for the same monthly cost as Tim?

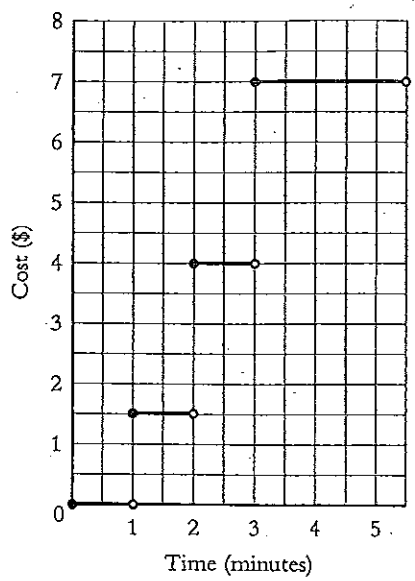
A 78
B 84
C 90
D 96

8 Consider the following graph. How much *more* is charged when making two 3-minute phone calls than making one call of 6 minutes duration?



A 37 cents
B 43 cents
C 49 cents
D 135 cents

9 During a special promotion a phone company charged the following for overseas calls:



Which statement is true?

A A 2 minute call costs $1.50.

B Calls cannot be made that are longer than $5\frac{1}{2}$ minutes.

C No charge is made for the first full minute of the call.

D A 240 second call costs $7.

10 One megabyte is equivalent to:

A 1 000 000 bytes

B 2^{20} bytes

C 1^{20} bytes

D $2 \times 1\,000\,000$ bytes

11 Written in increasing size order are:

A kilobyte, megabyte, gigabyte, terabyte

B megabyte, kilobyte, gigabyte, terabyte

C megabyte, gigabyte, kilobyte, terabyte

D terabyte, gigabyte, megabyte, kilobyte

12 Which of these is true?

A 1024 megabytes = 1 kilobyte

B 1024 kilobytes = 1 gigabyte

C 1024 gigabytes = 1 megabyte

D 1024 terabytes = 1 petabyte

13 Digital data is described in terms of bits and bytes. One kilobyte is equivalent to how many bits?

A 1000

B 8000

C 1024

D 8×2^{10}

14 Which calculation can be used to find the number of 2.4 GB movie files that can be stored on a hard drive with 4.5 TB of storage?

A $4.5 \times 1024 \div 2.4$

B $2.4 \times 1024 \div 4.5$

C $4.5 \div 1024 \div 2.4$

D $2.4 \times 1024 \times 4.5$

15 Which of the following is *not* a measure of the download speed for digital data?

A Mbps

B kilobits per second

C metres per second

D kilobytes per minute

16 Three phone plans are shown below:

	Plan A	Plan B	Plan C
Cost per 30 days	\$0	\$29.90	\$59.90
Standard calls	12¢/min	8¢/min	Unlimited
Standard SMS	10¢/SMS	7¢/SMS	Unlimited
Calls to 13 and 18 numbers	25¢/min	22¢/min	Unlimited
Voice mail	12¢/min	Unlimited	Unlimited

a What is the cost of making 34 standard calls using phone Plan B, each lasting (on average) 3 minutes? 1 mark

b What is the cost of making 73 standard SMS messages using phone Plan A? 1 mark

c Each month Mary makes, on average:

- 103 standard calls, each lasting around $3\frac{1}{2}$ minutes
- 120 SMS messages
- 8 calls to 1300 and 1800 numbers, each lasting around $7\frac{1}{4}$ minutes
- 5 voice mails, each lasting 50 seconds

Calculate her total monthly charge using:

i Plan A 1 mark

ii Plan B 1 mark

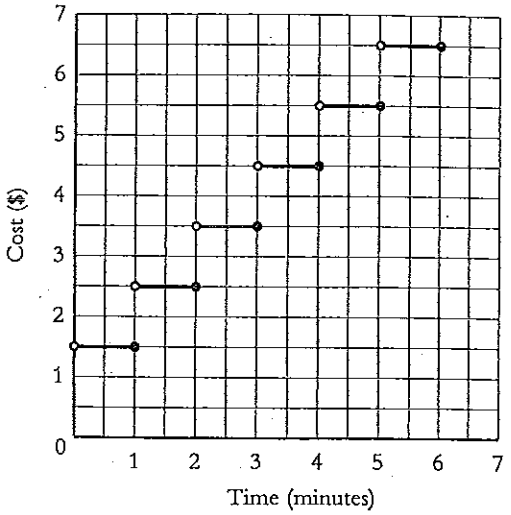
iii Plan C 1 mark

d For Mary's purposes, which plan should she go with? 1 mark

17 A company charges a connection fee plus a call rate of 35¢ for each 30 seconds or part thereof. Madeleine paid \$6.15 for a call lasting 7 minutes and 44 seconds. How much was the connection fee? 1 mark

18 In a phone plan a cost of 48¢ is charged to send a message having up to 256 characters. Longer messages are charged in multiples of 256 characters. What is the cost of sending a message with 1250 characters? 1 mark

19 The graph below shows the call charges for a mobile phone:



a What is the cost of a call lasting 5 minutes and 25 seconds? 1 mark

b Assume the cost per minute remains constant. What is the cost per minute? 1 mark

c What is the connection cost? 1 mark

d Ajit has $5.70 credit remaining. What is the longest call he can make, and how much money is left over? 1 mark

20 A 16 GB camera memory card can store 3140 photographs. What is the average size of each photo, in megabytes? 1 mark

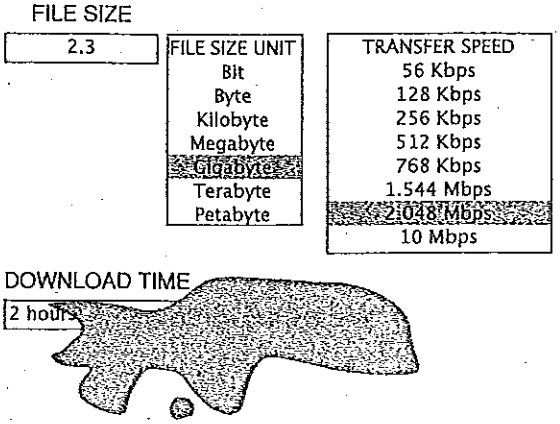
21 It took Denise 7 minutes 15 seconds to download an MP3 file that was 8.4 MB in size. Calculate the download speed, to the nearest kbps. 2 marks

22 An MP3 player has 60 songs and four are played at random, without any repeats.

a How many different combinations are possible? 1 mark

b Calculate the probability a particular song is played in the first four songs? 1 mark

23 Ludwig found a File Transfer Time/Data Transfer Speed calculator on the internet and copied a calculation to his book. However, he spilt coffee over the resulting time, but knew that it was longer than 2 hours.



Calculate the resulting time (in hours, minutes and seconds) correct to the nearest second. 3 marks

1 The $20 per month plans charges (2000 cents ÷ 1000 MB =) 2¢ per megabyte. ✓

2 People will pay more for their phone calls. It is very tempting to think the charge does not change; after all, 15¢ for each 30 seconds is the same as 30¢ for each 60 seconds, isn't it? But consider a person making a 70-second phone call. He will be charged 15 + 15 + 15 = 45¢ under the old plan because he is into his third 30-second time period. With the changed increments he will be charged 30 + 30 = 60¢ because he is into his second 60-second time period. There will be many such cases. (This is a sneaky way of increasing charges while arguing that all they are doing is tweaking billing time blocks while leaving the rate unchanged.) ✓

3 For mobile phones, the Call charge = Connection fee + Time used × Call rate. The other formulae are incorrect. ✓

4 Using the phone to receive calls and make the occasional emergency call will cost the least. The more frequently you use the phone, for whatever reasons, the more it will cost. ✓

5 There are four 15-second blocks in each minute. So in $3\frac{1}{2}$ minutes there are 3.5×4, 15-second blocks. The total cost is $12 \times 3.5 \times 4¢$. ✓

6 A prepaid plan requires the user to purchase credit in advance. The word 'prepaid' means to pay beforehand. ✓

7 Tim is charged $80 \times 24 = 1920$ cents, or $19.20. At 20¢ per SMS Tammy can make $\frac{1920}{20} = 96$ calls. ✓

8 Each 3 minute phone call costs 43¢. So two calls cost 86¢. A 6 minute call costs 49¢. The difference is $86 - 49 = 37¢$. ✓

9 240 seconds = 4 minutes (4 × 60 seconds) = $7 on the graph. ✓

10 One megabyte equals 2^{20} bytes. Refer back to the table you completed earlier in this chapter. ✓

11 Increasing order is kilobyte, megabyte, gigabyte, terabyte. ✓

12 1024 terabytes = 1 petabyte. The other answers are incorrect. ✓

13 There are 8 bits to a byte, and 1 kB = 1024 bytes. This makes a total of 8 × 1024 bits. This can also be expressed as 8×2^{10} bits. ✓

14 4.5 TB = 4.5 × 1024 GB. So the number of movies is 4.5 × 1024 ÷ 2.4. ✓

15 *Metres per second* is the speed for a moving object, such as a car or bicycle. Download speed on a computer is measured in bits or bytes per unit time length. ✓

16 a Cost of phone calls alone = 34 × 0.08 × 3 = $8.16 ✓

b Cost of SMS messages = 73 × 0.10 = $7.30 ✓

c i Cost of standard calls = 103 × 0.12 × 4 = $49.44
Cost of SMS = 120 × 0.10 = $12.00
Cost of 13 and 18 numbers = 8 × 0.25 × 8 = $16.00
Cost of voice mail = 5 × 0.12 × 1 = $0.60
Total cost = $49.44 + $12.00 + $16.00 + $0.60
= $78.04 ✓

ii Cost of standard calls = 103 × 0.08 × 4 = $32.96
Cost of SMS = 120 × 0.07 = $8.40
Cost of 13 and 18 numbers = 8 × 0.22 × 8 = $14.08
Cost of voice mail = $0.00
Total cost = $29.90 + $32.96 + $8.40 + $14.08 + $0.00
= $85.34 ✓

iii Cost of standard calls = $0
Cost of SMS = $0
Cost of 13 and 18 numbers = $0
Cost of voice mail = $0
Total cost = $59.90 ✓

d Plan C. While this plan might initially seem more costly because of the higher initial cost, it works out to be cheaper for Mary's purposes. ✓

17 A call of 7 minutes 44 seconds is charged for 16 half-minute blocks. The cost is 16 × 0.35 = $5.60. The difference between this and $6.15 is 55¢, and this is the connection fee. ✓

18 1250 ÷ 256 = 4.88, so the cost is 5 × 48 = 240¢, or $2.40 ✓

19 a $6.50 ✓

b $1 per minute ✓

c Given the first minute costs $1.50, and each minute is charged at $1, then the connection fee is $0.50. ✓

d The longest call is 5 minutes, costing $5.50, with 20¢ left over. ✓

20 16 GB = 16 × 1024 = 16 384 MB. Average size of each photo = 16 384 ÷ 3140 = 5.22 MB ✓

21 Download speed = $\frac{70464.3072}{7 \times 60 + 15}$ ✓
= 162 kbps ✓

22 a $60 \times 59 \times 58 \times 57 = 11\,703\,240$ ✓

b $\frac{4}{60} = \frac{1}{15}$ ✓

23 2.3 GB = $2.3 \times 2^{30} \times 8$ bits = 19 756 849 561.6 bits. ✓
This is 19756.8495616 megabits. At a transfer speed of 2.048 Mbps, it will take $\frac{19756.8495616}{2.048}$ seconds, which is 9646.8992 seconds. ✓
Rounded to the nearest second, this is 9647 seconds. Now to change this time into hours, minutes and seconds: 9647 ÷ 60 = 160.78 minutes = 2 hours 40 minutes 47 seconds. [160 minutes = 2 × 60 + 40, making 2 hours 40 minutes. And 0.78 of a minute is 0.78 × 60 = 46.8 seconds.] ✓