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Contents

Introduction .................................................................................................................................................. 1
Mathematics 30–1 Diploma Examination
November 2012 and January 2014 – Blueprint Summary ................................................................. 2
Mathematics 30–1 Diploma Examination
November 2012 and January 2014 – Released Items .......................................................................... 3
Introduction

The questions in this booklet are a sample set of questions from the November 2012 and the January 2014 Mathematics 30–1 Diploma Examinations. Teachers may wish to use these questions in a variety of ways to help students develop and demonstrate an understanding of the concepts described in the Mathematics 30–1 Program of Studies. This material, along with the Program of Studies, Information Bulletin, and the Assessment Standards and Exemplars can provide insights that assist you with decisions about instructional planning.

These questions are released in both English and French by the Assessment Sector.

Additional Documents

The Assessment Sector supports the instruction of Mathematics 30–1 with the following documents available online at www.education.alberta.ca.

- Mathematics 30–1 Information Bulletin and Mathematics 30–1 Assessment Standards and Exemplars
  Available at education.alberta.ca.
  From the home page, follow this path: Teachers > (Additional Programs and Services) Diploma Exams > Information Bulletins.
  Contains information about the diploma examinations for the upcoming school year, and sample questions.

- School Reports and Instructional Group Reports
  Available at https://phoenix.edc.gov.ab.ca/login.
  Detailed statistical information on provincial, group, and individual student performance on the entire examination.
**Mathematics 30–1 Diploma Examination**  
**November 2012 and January 2014 – Blueprint Summary**

The following table gives results for the machine-scored questions released from the examination and shows the percentage of students that answered each question correctly. For each question, the table also gives the correct response, the topic, the outcome, the standard, and the cognitive levels.

<table>
<thead>
<tr>
<th>Released Item</th>
<th>Diff.*</th>
<th>Key</th>
<th>Topic</th>
<th>Outcome</th>
<th>Cognitive Level</th>
<th>Standard</th>
<th>Original Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC 1</td>
<td>76.9%</td>
<td>A</td>
<td>RF</td>
<td>3</td>
<td>C</td>
<td>A</td>
<td>Nov 2012 MC1</td>
</tr>
<tr>
<td>MC 2</td>
<td>47.6%</td>
<td>B</td>
<td>RF</td>
<td>6</td>
<td>C</td>
<td>A</td>
<td>Nov 2012 MC3</td>
</tr>
<tr>
<td>MC 3</td>
<td>76.9%</td>
<td>C</td>
<td>RF</td>
<td>7</td>
<td>C</td>
<td>A</td>
<td>Nov 2012 MC5</td>
</tr>
<tr>
<td>MC 4</td>
<td>78.2%</td>
<td>C</td>
<td>RF</td>
<td>10</td>
<td>PS</td>
<td>E</td>
<td>Nov 2012 MC6</td>
</tr>
<tr>
<td>MC 5</td>
<td>59.2%</td>
<td>D</td>
<td>RF</td>
<td>9</td>
<td>PS</td>
<td>A</td>
<td>Nov 2012 MC7</td>
</tr>
<tr>
<td>NR 1</td>
<td>53.1%</td>
<td>2.02</td>
<td>RF</td>
<td>8</td>
<td>P</td>
<td>A</td>
<td>Nov 2012 NR4</td>
</tr>
<tr>
<td>NR 2</td>
<td>55.8%</td>
<td>145(AO)</td>
<td>RF</td>
<td>12</td>
<td>C</td>
<td>A</td>
<td>Nov 2012 NR6</td>
</tr>
<tr>
<td>MC 6</td>
<td>78.2%</td>
<td>B</td>
<td>RF</td>
<td>11</td>
<td>P</td>
<td>A</td>
<td>Nov 2012 MC10</td>
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<tr>
<td>MC 7</td>
<td>21.2%</td>
<td>D</td>
<td>TRIG</td>
<td>1</td>
<td>PS</td>
<td>E</td>
<td>Jan 2014 MC17</td>
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<tr>
<td>MC 8</td>
<td>78.4%</td>
<td>C</td>
<td>TRIG</td>
<td>2</td>
<td>C</td>
<td>A</td>
<td>Jan 2014 MC19</td>
</tr>
<tr>
<td>MC 9</td>
<td>73.6%</td>
<td>A</td>
<td>TRIG</td>
<td>6</td>
<td>PS</td>
<td>E</td>
<td>Jan 2014 MC23</td>
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<tr>
<td>MC 10</td>
<td>72.8%</td>
<td>B</td>
<td>TRIG</td>
<td>4</td>
<td>PS</td>
<td>E</td>
<td>Nov 2012 MC20</td>
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<tr>
<td>NR 3</td>
<td>71.4%</td>
<td>60</td>
<td>PCBT</td>
<td>2</td>
<td>PS</td>
<td>A</td>
<td>Nov 2012 NR11</td>
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<tr>
<td>MC 11</td>
<td>38.4%</td>
<td>C</td>
<td>PCBT</td>
<td>2</td>
<td>C</td>
<td>A</td>
<td>Jan 2014 MC26</td>
</tr>
<tr>
<td>MC 12</td>
<td>59.2%</td>
<td>A</td>
<td>PCBT</td>
<td>4</td>
<td>PS</td>
<td>E</td>
<td>Nov 2012 MC28</td>
</tr>
</tbody>
</table>

*Difficulty—proportion of students answering the question correctly*
Use the following information to answer the first question.

The graph of \( y = f(x) \) is shown below.

1. The graphs of \( y = f(x) \) and \( y = 3f(x) \) intersect at
   
   A. Point A  
   B. Point D  
   C. Points B and F  
   D. Points C and E
Use the following information to answer the next question.

The graph of \( y = f(x) \) is shown below.

2. When the graph of \( y = f(x) \) is reflected in the line \( y = x \), the number of invariant points is
   A. one
   B. two
   C. three
   D. four

3. If \( \log_x y = a \), then an equivalent expression for \( y^2 \) is
   A. \( a^x \)
   B. \( a^{2x} \)
   C. \( x^{2a} \)
   D. \( 2x^a \)
Earthquake intensity, $I$, is given by the equation

$$I = I_0(10)^m,$$

where $m$ is the magnitude measured to the nearest tenth on the Richter scale and $I_0$ is the reference intensity.

In 1906, the San Francisco Bay area had an earthquake with a magnitude of 7.8 on the Richter scale.

4. What is the magnitude of an earthquake that is 158 times less intense than the 1906 San Francisco Bay earthquake?

A. 2.2  
B. 3.5  
C. 5.6  
D. 6.3
Use the following information to answer the next question.

Points $P(k, 2)$ and $Q\left(2, \frac{1}{3}\right)$ lie on the partial graph of $y = \log_b x$, as shown below.

5. The value of $k$ is
   
   A. 8  
   B. 12  
   C. 36  
   D. 64

### Numerical Response

1. If $\log_5 x - \log_5(x - 2) = 3$, then the value of $x$, to the nearest hundredth, is ________.

   (Record your answer in the numerical-response section on the answer sheet.)
Use the following information to answer the next question.

The following are some possible characteristics of the graph of \( y = f(x) \) above.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Sign of ( a )</th>
<th>Values of ( b ) and ( c )</th>
</tr>
</thead>
</table>
| 1  \( y = a(x - b)^2(x - c)^3 \) | 3 Positive | 5 \( b > 0 \)  
| | | \( c < 0 \) |
| 2  \( y = ax(x - b)(x - c)^3 \) | 4 Negative | 6 \( b < 0 \)  
| | | \( c > 0 \) |

**Numerical Response**

2. The characteristics that describe the function \( y = f(x) \) are _____, _____, and _____.  

(Record all three digits of your answer in any order in the numerical-response section on the answer sheet.)

6. Which of the following binomials is a factor of the polynomial function \( f(x) = 3x^3 + 8x^2 - x - 10 \)?

A. \((x + 1)\)  
B. \((3x + 5)\)  
C. \((x + 10)\)  
D. \((3x + 2)\)
Use the following information to answer the next question.

The wiper on the rear window of a particular car moves through an angle of $\frac{5\pi}{6}$ rad in a single sweep and clears a region that is 16 in wide, as shown in the diagram below.

7. The total perimeter of the cleared region, to the nearest inch, is

A. 52 in  
B. 63 in  
C. 84 in  
D. 95 in

Use the following information to answer the next question.

Point $A(x, y)$ is the intersection point of the unit circle and the terminal arm of $145^\circ$ in standard position.

8. The coordinates of Point $A$, to the nearest hundredth, are

A. $(-0.57, 0.82)$  
B. $(0.57, -0.82)$  
C. $(-0.82, 0.57)$  
D. $(0.82, -0.57)$
9. An expression that is equivalent to \( \frac{\cos(2x) + 2\sin^2x}{1 + \tan^2x} \), where \( x \neq \frac{n\pi}{2}, n \in \mathbb{I} \), is

A. \( \cos^2x \)

B. \( \sin^2x \)

C. \( \frac{1}{\cos^2x} \)

D. \( \frac{1}{\sin^2x} \)
Use the following information to answer the next question.

The London Eye is an observation wheel with a radius of 68 m. Rides consist of one complete revolution, which takes 30 minutes, and begin on a platform 2 m above the ground.

The height, \( h(t) \), in metres, of a rider above the ground as a function of time, \( t \), in minutes, can be expressed as \( h(t) = a \sin[b(t - c)] + d \).

10. Which of the following equations could represent the function \( h(t) \)?

A. \( h(t) = 68 \sin\left[\frac{\pi}{15} (t + 7.5)\right] + 68 \)
B. \( h(t) = 68 \sin\left[\frac{\pi}{15} (t - 7.5)\right] + 70 \)
C. \( h(t) = 34 \sin\left[\frac{\pi}{30} (t + 7.5)\right] + 70 \)
D. \( h(t) = 34 \sin\left[\frac{\pi}{30} (t - 7.5)\right] + 68 \)
Use the following information to answer the next question.

Two-year-old Darren is playing with a train set that has an engine and detachable train cars. The letters are glued to the engine and the cars, and the two cars with the letter R are identical. Darren does not know how to spell his name, but he knows that the engine with the letter D must be in front.

Numerical Response

3. The total number of different possible arrangements of all the train cars, with the engine in front, is __________.

(Record your answer in the numerical-response section on the answer sheet.)
12. For the general term $t_{k+1}$ in the expansion of $(x^a + y)^n$, written in descending powers of $x$, the exponent of the variable $x$ is

A. $an - ak$
B. $ak + a$
C. $an + a$
D. $n - k$