

Photo Credits

iv Big Ideas Learning, LLC; viii top ©iStockphoto.com/Lisa Thornberg, ©iStockphoto.com/Ann Marie Kurtz; bottom Evok20; ix top ©iStockphoto.com/Jonathan Larsen; bottom Apollofoto; x top ©iStockphoto.com/Angel Rodriguez, ©iStockphoto.com/Ann Marie Kurtz; bottom ©iStockphoto.com/daaronj; xi ©iStockphoto.com/Ron Sumners, ©iStockphoto.com/Ann Marie Kurtz; bottom Apollofoto; xii top ©iStockphoto.com/Stefan Klein; bottom ©iStockphoto.com/ronen; xiii top ©iStockphoto.com/Michael Flippo, ©iStockphoto.com/Ann Marie Kurtz; bottom Heather Prosch-Jensen; xiv top ©iStockphoto.com/Alistair Cotton; bottom Peter Close; xv top ©iStockphoto.com/Angel Rodriguez, ©iStockphoto.com/Ann Marie Kurtz; bottom ©iStockphoto.com/ranplet; xvi top ©iStockphoto.com/Varina and Jay Patel, ©iStockphoto.com/Ann Marie Kurtz; bottom Jane Norton; xvii top Cigdem Cooper, ©iStockphoto.com/Andreas Gradin, stephan kerkhofs; bottom ©iStockphoto.com/Thomas Perkins; xviii ©iStockphoto.com/Ekaterina Monakhova; 1 ©iStockphoto.com/Lisa Thornberg, ©iStockphoto.com/Ann Marie Kurtz; 6 ©iStockphoto.com/David Freund; 7 ©iStockphoto.com/shapecharge; 8 NASA; 9 ©iStockphoto.com/Judson Lane; 12 ©iStockphoto.com/harley_mccabe; 13 ©iStockphoto.com/Jacom Stephens; 14 ©iStockphoto.com/Harry Hu; 15 ©Paul Slaughter; 20 ©iStockphoto.com/Andrey Krasnov; 29 top right ©iStockphoto.com/Alan Crawford; center left ©iStockphoto.com/Julio Yeste; center right ©iStockphoto.com/Mark Stay; 31 ©iStockphoto.com/Michel de Nijs; 33 Steve MacAulay Photography; 34 top Benedict S. Gibson; bottom Frantz Petion; 35 Dehk; 36 bottom right ©iStockphoto.com/Paul Tessier; center left Tom Uhlenberg; top right ©iStockphoto.com/polarica; 37 ©iStockphoto.com/Winston Davidian; 38 ©iStockphoto.com/Steve Mcsweeney; 41 ©iStockphoto.com/machinim; 46 ©iStockphoto.com/Jonathan Larsen; 51 NASA; 52 ©iStockphoto.com/David Morgan; 53 center left ©iStockphoto.com/Jakub Semenik; top right NASA; 60 ©iStockphoto.com/Amanda Rohde; 61 Julián Rovagnati; 66 ©iStockphoto.com/whitechild; 67 top right Jerry Horbert; bottom left ©iStockphoto.com/Chris Schmidt; 69 ©iStockphoto.com/Peter Finnie; 72 ©iStockphoto.com/Stephen Pothier; 73 bottom Dewayne Flowers; top Gina Smith; 75 Philip Lange; 76 Howard Sandler, ©iStockphoto.com/Dori O'Connell; 79 Yuri Arcurs; 80 ©iStockphoto.com/Kathy Hicks; 81 ©iStockphoto.com/webphotographeer; 82 ©iStockphoto.com/walik; 86 ©iStockphoto.com/Corina Estepa; 87 ©iStockphoto.com/Tomislav Forgo; 91 Kateryna Potrokhova; 92 ©iStockphoto.com/Jason Stit; 93 ©iStockphoto.com/Gabor Izso, ©iStockphoto.com/Dawn Jagroop; 94 ©iStockphoto.com/ZanyZeus; 98 ©iStockphoto.com/Justin Horrocks; 104 ©iStockphoto.com/Angel Rodriguez, ©iStockphoto.com/Ann Marie Kurtz; 109 Photo courtesy of Herrenknecht AG; 110 ©iStockphoto.com/Adam Mattel; 111 center right ©iStockphoto.com/Pawel Liprec, ©iStockphoto.com/beetle8; top left ©iStockphoto.com/Gene Chutka; 113 ©iStockphoto.com/Kirsty Pargeter, 115 ©iStockphoto.com/Connie Maher; 116 ©iStockphoto.com/Jacom Stephens; 117 center left ©iStockphoto.com/Andrea Krause; top right ©iStockphoto.com/Petr Podzemny; 121 ©iStockphoto.com/Michael Chen; 123 bottom ©iStockphoto.com/adrian beesley; top ©iStockphoto.com/Brian McEntire; 125 center right ©iStockphoto.com/John Kounadeas; bottom right ©iStockphoto.com/Rich Yasick; 128 ©iStockphoto.com/Ryan Putnam; 129 ©iStockphoto.com/ILexx; 130 ©iStockphoto.com/Jeremy Edwards; 131 ©iStockphoto.com/Robert Kohlhuber; 136 center left ©iStockphoto.com/George Peters; center right ©iStockphoto.com/Olga Shelego; bottom left ©iStockphoto.com/Valerie Loiseleux; 137 ©iStockphoto.com/Duncan Walker; 140 ©iStockphoto.com/Marcio Silva; 142 ©iStockphoto.com/Carmen Martínez Banús; 146 ©iStockphoto.com/Ron Sumners, ©iStockphoto.com/Ann Marie Kurtz; 149 right ©2010 Zappos.com, Inc.; left ©iStockphoto.com/Andrew Johnson; 151 ©iStockphoto.com/alohaspiri; 152 ©iStockphoto.com/Timur Kulgarin; 153 center right Primo Ponies Photography; center left ©iStockphoto.com/Wayne Johnson; 155 Digital Vision Royalty Free Photograph/Getty Images; 158 ©iStockphoto.com/Hannu Liivaar; 159 center left ©iStockphoto.com/LoopAll; center right ©iStockphoto.com/Justin Horrocks, ©iStockphoto.com/Ana Abejon, ©iStockphoto.com/Huchen Lu; 161 ©iStockphoto.com/Lisa F. Young; 165 ©iStockphoto.com/technot; 167 top ©iStockphoto.com/Alexander Hafemann; bottom ©iStockphoto.com/medobear; 169 left ©iStockphoto.com/PeskyMonkey; right ©iStockphoto.com/shapecharge; 173 top right ©iStockphoto.com/Dean Turner; bottom ©iStockphoto.com/Mladen Mladenov; center ©iStockphoto.com/Tom Buttle; 176 Junial Enterprises; 178 ©iStockphoto.com/Louis Aguinaldo; 182 ©iStockphoto.com/Stefan Klein; 189 ©iStockphoto.com/Jorgen Jacobsen; 194 exercise 9 ©iStockphoto.com/Chih-Feng Chen; exercise 10 ©iStockphoto.com/Andreas Gradin; exercise 11 ©iStockphoto.com/Jim Lopes; 195 ©iStockphoto.com/Zoran Kolundzija; 198 center Booker Middle School; bottom left ©iStockphoto.com/Black Jack 3D; bottom right ©iStockphoto.com/Vadym Volodin; 199 NASA; 202 ©iStockphoto.com/Evelyn Peyton; 203 top left ©iStockphoto.com/Lora Clark; top right ©iStockphoto.com/Terraxplorer; 212 Estate Craft Homes, Inc.; 228 ©iStockphoto.com/Michael Flippo, ©iStockphoto.com/Ann Marie Kurtz; 233 Perfectblue97; 234 ©iStockphoto.com/Benjamin Lazare; 235 center ©iStockphoto.com/Jill Chen; top right ©iStockphoto.com/Sheldon Kralstein; 236 ©ImageState 240 ©iStockphoto.com/Melissa Carroll; 241 center right ©iStockphoto.com/Cathy Keifer; center left ©iStockphoto.com/Alex Slobodkin, ©iStockphoto.com/Sebastian Duda; 243 bottom right ©iStockphoto.com/MACIEJ NOSKOWSKI; center left ©iStockphoto.com/Yvan Dubé 244 ©iStockphoto.com/Kais Tolmats; 248 top left ©iStockphoto.com/Don Bayley; bottom right ©iStockphoto.com/ILexx; 251 ©iStockphoto.com/Marcio Silva; 253 Luminis; 256 exercise 3 Joshua Haviv; exercise 4 ©iStockphoto.com/William D Fergus McNeill;

exercise 5 ©iStockphoto.com/Klaas Jan Schraa; 257 left ©iStockphoto.com/Parema; right ©iStockphoto.com/Nikontiger; 267 center right Hasan Shaheed; bottom left ©iStockphoto.com/JenDen2005; bottom right Orla; 268 center right CD Lenzen; bottom left red06; 272 ©iStockphoto.com/Alistair Cotton 278 ©iStockphoto.com/Jan Will; 279 Elena Elisseeva; 281 Laurence Gough; 282 Frederic J. Brown/Getty Images; 284 ©iStockphoto.com/Mike Elliott; 285 Monkey Business Images; 287 ©iStockphoto.com/David15; 288 Gina Brockett; 289 ©iStockphoto.com/CraigRJD; 293 ©iStockphoto.com/Jill Fromer; 294 ©iStockphoto.com/Janis Litavnieks; 295 DLD; 296 bottom right ©iStockphoto.com/Eric Isselée; center left ©iStockphoto.com/Tony Campbell; 297 top right Larry Korhnak; center right Photo by Andy Newman; 301 center left ©iStockphoto.com/Jane norton; center right ©iStockphoto.com/Krzysztof Zmij; 302 Dwight Smith; 304 Nikola Bilic; 305 WizData, inc.; 310 ©iStockphoto.com/Angel Rodriguez, ©iStockphoto.com/Ann Marie Kurtz; 313 ©iStockphoto.com/Floortje; 317 top The ESRB rating icons are registered trademarks of the Entertainment Software Association; center right ©iStockphoto.com/Richard Goerg; 318 ©iStockphoto.com/George Peters; 319 ©iStockphoto.com/George Peters; 322 pandapaw; 323 ©iStockphoto.com/Daniel Van Beek; 325 ©iStockphoto.com/Eric Simard; 331 Alexander Kalina; 332 top right ©iStockphoto.com/Martin Firus; bottom Robert Pernel; 333 ©iStockphoto.com/Trevor Fisher; 338 ©iStockphoto.com/fotoVoyager; 339 exercise 26 ©iStockphoto.com/Jill Chen; exercise 27 ©iStockphoto.com/7unit; exercise 28 ©iStockphoto.com/George Clerck; 340 Tatiana Popova; 344 ©iStockphoto.com/Heather Shimmin, ©iStockphoto.com/itographer; 348 ©iStockphoto.com/Varina and Jay Patel, ©iStockphoto.com/Ann Marie Kurtz; 350 ©iStockphoto.com/Franck Boston; 351 activity 3a NASA; activity 3b NASA/JPL-Caltech/R. Hurt (SSC); activity 3c NASA; activity 3d NASA; center right; Stevyn Colgan; 353 ©iStockphoto.com/Philippa Banks; 354 ©iStockphoto.com/Clotilde Hulin; 355 ©iStockphoto.com/Boris Yankov; 356 ©iStockphoto.com/John Tomaselli; 360 ©iStockphoto.com/Viktoria Kulish; 361 top right ©iStockphoto.com/Paul Tessier; center left ©iStockphoto.com/Marie-france Bélanger, ©iStockphoto.com/Valerie Loiseleux, ©iStockphoto.com/Linda Steward; 366 ©iStockphoto.com/Andrey Volodin; 367 top right Dash; 367 center left NASA/JPL-Caltech/L. Cieza (UT Austin); 369 ©iStockphoto.com/Dan Moore; 373 ©iStockphoto.com/Aliaksandr Autayeu; 374 EugeneF; 375 ©iStockphoto.com/Nancy Louie; 376 ©iStockphoto.com/Kais Tolmats; 377 top ©iStockphoto.com/Sebastian Kaulitzki; center ©iStockphoto.com/Henrik Jonsson; bottom 7artscreensavers.com; 379 top center ©iStockphoto.com/Frank Wright; top left ©iStockphoto.com/Mark Stay; bottom left ©iStockphoto.com/Oliver Sun Kim; top right ©iStockphoto.com/Evgeniy Ivanov; 380 ©iStockphoto.com/ChristianAnthony; 381 Microgen; 382 ©iStockphoto.com/camilla wisbauer, ©iStockphoto.com/David Freund, ©iStockphoto.com/Joel Belanger, ©iStockphoto.com/Oliver Barker; 386 bottom left ©iStockphoto.com/Susan Trigg; 383 NASA; 384 center left Google logo ©Google Inc., 2010. Reprinted with Permission.; center right YouTube logo ©Google Inc., 2010. Reprinted with Permission.; 385 Elaine Barker; 386 bottom left ©iStockphoto.com/angelhell; bottom right ©iStockphoto.com/Jan Rysavy; 387 BORTEL Pavel; 387B center left Sebastian Kaulitzki; center right ©iStockphoto.com/Jan Rysavy; bottom right ©iStockphoto.com/Wikipedia Commons; 392 bottom right ©iStockphoto.com/Eric Holsinger; center left Eric Isselée; 396 Cigdem Cooper, ©iStockphoto.com/Andreas Gradin, stephan kerkhofs; 403 ©iStockphoto.com/Yury Kosourov; A0 ©iStockphoto.com/Björn Kindler; center left ©iStockphoto.com/Mika Makkonen; center right ©iStockphoto.com/Hsing-WenHsu; A1 top right Emmer, Michele, ed., The Visual Mind: Art and Mathematics, Plate 2, ©1993 Massachusetts Institute of Technology, by permission of The MIT Press.; bottom left ©iStockphoto.com/Andrew Cribb; bottom right NASA; A4 top right ©iStockphoto.com/Hsing-WenHsu; center right ©iStockphoto.com/blackred; bottom left ©iStockphoto.com/Thomas Kuest; bottom right ©iStockphoto.com/Lim ChewHow; A5 top right ©iStockphoto.com/Richard Cano; bottom left ©iStockphoto.com/best-photo; bottom right ©iStockphoto.com/Mika Makkonen; A6 Emmer, Michele, ed., The Visual Mind: Art and Mathematics, Plate 2, ©1993 Massachusetts Institute of Technology, by permission of The MIT Press.; A7 top right Elena Borodynkina; center right ©iStockphoto.com/Andrew Cribb; bottom left ©iStockphoto.com/Matthew Okimi; bottom right Vladimir Bulatov; A8 NASA; A9 NASA

Cartoon illustrations Tyler Stout
Cover image Lechner & Benson Design